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ECOLOGICAL AND TRANSECT SURVEY STUDIES ON FINNISH CAMISIIDS

(ACAR., ORIBATEI)

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With 29 Figs. and 14 Tables in the text

Selostus:
Suomen Camisiidae-punkkeja koskevia ekologisia ja linja-arviointitutkimuksia.

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1. INTRODUCTION

The microfauna of the soil includes many groups of animals largely neglected in this country, e.g., Protozoa, Rotatoria, Tardigrada and Acarida.[1] Even elsewhere there have been few specialists on Acarids (cf. SELLNICK 1954), but some of the results so far obtained by these authors already constitute a remarkable contribution to both pure and applied zoology. FRANZ (1950 a, 1950 b) emphasizes the important role of the microfauna in the decomposition of organic matter in cultivated soil. FORSSLUND's (1938, 1943) results, e.g., show that the forest soil animals, in spite of their small size, are important accelerators of organic circulation. Thanks to the microfauna, the circulation of nitrogen, etc., is accelerated, since most species of the microfauna use for their nutrition the mycelia of fungi. When passing through the alimentary canal of these animals, the mycelium becomes utilisable, which is of importance from the viewpoint of plant nutrition, for instance.

In forests and peatlands, the localities particularly dealt with in the present paper, the Oribatid mites are of great significance in the decomposition of organic matter. Their number in these localities is considerably higher than that of other groups of mites belonging to the microfauna (FORSSLUND 1943); moreover, they depend primarily on mycelium for their nutrition (FORSSLUND 1938).

Apart from those by the present author, only two works on the Oribatid mites have been published in this country. NORDENSKIÖLD (1901) recorded 69 species from Finland. At that time, methods of investigation were still imperfect; for instance, the automatic separating device of BERLESE (1905) was unknown, and the results were rather inaccurate in regard to number of species, as compared with samples obtained with modern equipment, even though these too have been found imperfect whenever quantitative investigations are carried out. NORDBERG (1936) recorded from Finland about 90 Oribatid species from birds' nests.

The object of this paper is to describe the distribution in Finland of the species belonging to the family *Camisiidae* and to review in outline their occurrence in the soil of various forest and peatland vegetation types.

The family Camisiidae has been chosen as the particular subject of this study, because the representatives of this family are of sufficient size to allow of their practically quantitative separation from the soil samples by means of the methods at present available. This is certainly not the case with smaller species with a thin cuticle (for details cf. p. 53). For the same reason the young stages of the Camisiid species could not be taken into account in the quantitative study, since they dry out very quickly and do not emerge quantitatively from the samples. Consequently, the quantitative investigations are based on the adults only. In the qualitative study the young stages have also been considered, insofar as it has been possible to determine them with certainty. In the determination of young stages a key by TUXEN (1952) has proved very useful.

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[1] Of the Acarida, only the plant-inhabiting *Eriophyidae* are known at all well (LIRO & ROIVAINEN 1951).

2. GENERAL TECHNIQUE OF THE SAMPLING

Numerous modifications of the well-known apparatus invented by BERLESE (1905) have been employed for separating soil animals from the substratum (for review see FORSSLUND 1945 and 1948, e.g.). It is, however, generally understood that each systematic group of soil animals requires a collecting technique specially improved for the case in question. It is also understood that the BERLESE method does not fit in respect of many groups of soil animals (cf. ØVERGAARD 1948, RENKONEN 1949, e.g.).

As regards the soil mites, a separating device based on the BERLESE method was described by TRÄGÅRDH & FORSSLUND (1932), where the drying of the soil sample is accelerated by a heating water jacket and an electric lamp hanging over the substratum. More recently, attention has been paid to the effect of different modifications of the sampling technique upon the results obtained (FORSSLUND 1948, e.g.). It has been shown that the size of the soil sample studied has to be carefully determined in order to achieve quantitative separation of the animals that may remain in the soil when employing too large blocks of substratum. Moreover, it has been shown that too rapid drying of the samples may cause significant losses, since many delicate forms may be desiccated before they separate from the samples. For this reason, artificial acceleration of the drying process will be unfavourable in many cases.

In the present investigation, it was found most suitable to use 50 cc. soil samples. According to FORSSLUND (1948), Oribatids with a thick cuticle are separated quantitatively from samples of this size. In the beginning, 20 cc. samples were used, but it was then established that samples of this size would have given individual numbers too small for comparison or even left some species unrepresented.

The samples were taken with a device (Fig. 1) made according to directions received from Mr. RENKONEN.

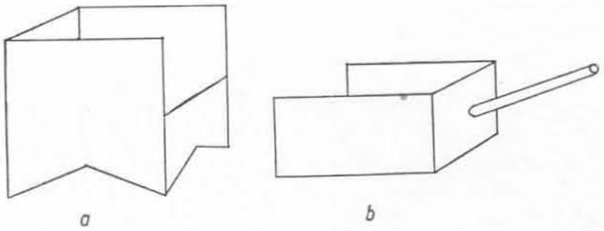

Fig. 1. The steel box and the scoop employed. For explanation see the text.

A box of steel sheet in the form of a cube with wedge-shaped and sharpened lower edges (a) is pressed into the earth with the foot. The scoop (b) is inserted through the recess in the side of the box after the earth has been removed on this side. The scoop will thus detach a piece of soil 10 × 10 × 5 cm in size. Unfortunately this device cannot be used in wet, unhumified peatlands, since the surface of the peatland is not cut, even though the edges of the box are sharpened, and the substrate is merely depressed by the box, which only collects water. Even if it were possible to cut through the surface by exerting sufficient pressure upon the box, the quantitativeness of the figures thus arrived at for the numbers of the different species would be questionable, as without doubt some of the animals would be flushed away with the water escaping from the box when it was raised. The best procedure in such localities is to cut with shears a piece of corresponding surface area, cutting deeper than 5 cm. When the fingers are pushed into the cut, it is possible to lift out a section of the sod and thereafter trim it to 5 cm thickness. A piece 2 cm in thickness and 25 cm^2 in area was cut from samples taken in the ways described, and the Camisiid fauna investigated. The ultimate size of the sample was thus 50 cc. In the quantitative investigations I have divided the sample vertically into three layers (comp. p. 54).

In the handling of the soil samples a modification of BERLESE's device was employed.

The funnels were glass funnels of about 13 cm in diameter. These were placed in wooden racks, some designed to accomodate 4 funnels, the larger ones 36 funnels. Having 12 racks of the first and 3 of the second kind at my disposal, I was able to deal simultaneously with 156 soil samples in case of need. The glass funnels were covered with sieve plates 10 cm in diameter, made of 1 mm mesh steel wire gauze. The rim of the sieve plate, which was made of steel wire, has four projections which support the plate above the funnel. I did not use any heating by means of a lamp or a water jacket; the samples were merely left to dry slowly at room temperature (about 20°C) for 10 days. In my opinion this procedure is safer, since heating may cause some of the animals, in this case particularly the younger stages of the Camisiids with a thinner cuticle, to be killed by dessication before they succeed in emerging from the soil sample. This method has also been used by FORSSLUND (1948). The animals were collected in 50 cc. bottles, 70—80 % ethyl alcohol being used as preserving fluid.

Particularly in connection with the transect survey work, samples were obtained in such profusion that they could not be investigated immediately, and for this reason the animals had to be collected in bottles. It is true that a bottle is by no means a good receptacle, as it must be rinsed very carefully before the commencement of the investigation if one is to be sure that all the animals have been extracted. However, TRÄGÅRDH and FORSSLUND (1932) have found that it is mainly Thrombidiids and Collemboles that remain in the bottles. To make doubly sure, I have finally examined the emptied bottles under a binocular microscope at 32 × magnification.

3. MATERIAL

During the summers of 1951, 1952 and 1953 the third transect survey of the forests of Finland was performed. On this occasion, each survey group was accompanied by a biologist whose duty it was to make certain botanical and zoological observations and to collect material for investigations. The author is indebted to the biologists for a large amount of material; they have sent me soil samples from pine peat-bogs as well as from forests of the Vaccinium and the Empetrum-Myrtillus types. Some of the lines were surveyed without biologists, but even in these cases I obtained some samples from the foresters. Altogether I have received 1 595 samples from the transect survey.

The samples obtained in connection with the transect surveys have been treated as qualitative samples only. In addition to these I have personally taken series of 100 samples each from various types of forests and bogs in order to determine the Camisiid fauna of as many different types of forests and peatlands as possible and simultaneously also the constancy and abundance of the species occurring in these localities. The samples from the Hylocomium-Myrtillus type were sent from Siulionpalo, a rural district in Pelkosenniemi (KemL), by Mr. G. SIRÉN. Thus another 1 100 samples have been investigated in addition to the transect survey samples, the total number of samples being 2 695. Moreover, certain sample series were taken at regular intervals in order to study the influence of several environmental factors upon the Camisiid populations.

Table 1 gives a list of the transect survey samples received. In addition to the rural district from which the sample has been sent, the biological province and the Camisiid species found in the sample have also been given. A map showing the position of the different biological provinces of Finland will be found at the end of this paper.

Table 1. List of the transect survey samples. Abbreviations: *Cl* = *Camisia lapponica*, *Csc* = *Camisia scabra*, *Csc* = *Camisia segnis*, *Csp* = *Camisia spinifer*, *Hp* = *Heminothrus paolianus*, *Ht* = *Heminothrus targionii*, *Nb* = *Nothrus borussicus*, *Nh* = *Neonothrus humicola*, *Np* = *Nothrus pratensis*, *Ns* = *Nothrus silvestris*, *Pc* = *Platynothrus capillatus* var. *septentrionalis*, *Ppc* = *Platynothrus peltifer*, *Ppu* = *Platynothrus punctatus*.. The samples nos. 1—525 were collected in 1951, nos. 600—1328 in 1952 and nos. 1329—1670 in 1953. The letters in parentheses after the name of each locality refer to the map of the biological provinces of Finland at the end of this paper. The letters after the date of collecting are abbreviations of the forest and peatland vegetation types (see p. 35).

1. Vilppula (EH) 7. VI, *IR*; —
2. Vilppula (EH) 7. VI, *VT*; *Ns*, *Cl*
3. Kustavi (V) 5. VI, *VT*; *Ns*, *Hp*
4. Korkeakoski (EH) 8. VI, *VT*; —
5. Parainen (V) 8. VI, *VT*; —
6. Parainen (V) 8. VI, *VT*; *Ns*
7. Porvoo (U) 5. VI, *KgR*; —
8. Porvoo (U) 5. VI, *VT*; *Ns*
9. Turku (V) 8. VI, *VT*; —
10. Korkeakoski (EH) 8. VI, *VT*; *Ns*
11. Espoo (U) 7. VI, *VT*; —
12. Kirkkonummi (U) 8. VI, *R*; —
13. Korkeakoski (EH) 8. VI, *VT*; *Ns*
14. Kirkkonummi (U) 8. VI, *R*; *Np*
15. Karuna (V) 8. VI, *VT*; —
16. Mänttä (EH) 9. VI, *VT*; *Ns*, *Csc*, *Hp*, *Cl*
17. Karuna (V) 8. VI, *VT*; —
18. Karuna (V) 8. VI, *VT*; —
19. Karuna (V) 8. VI, *VT*; —
20. Vehkalahti (EK) 8. VI, *VT*; *Ns*
21. Vehkalahti (EK) 8. VI, *R*; *Hp*
22. Vehkalahti (EK) 8. VI, *VT*; —
23. Lokalahti (V) 8. VI, *VT*; *Ns*
24. Sotkamo (Kn) 7. VI, *VT*; —
25. Sotkamo (Kn) 6. VI, *VT*; —
26. Lieto (V) 11. VI, *VT*; *Ns*
27. Lieto (V) 11. VI, *VT*; *Ns*, *Hp*, *Csp*
28. Kalanti (V) 9. VI, *VT*; *Ns*
29. Mänttä (EH) 12. VI, *VT*; *Ns*
30. Kalanti (V) 12. VI, *VT*; —
31. Kalanti (V) 12. VI, *VT*; *Ns*
32. Vehkalahti (EK) 12. VI, *VT*; *Ns*
33. Tammisaari (U) 12. VI, *KR*; *Np*
34. Tammisaari (U) 12. VI, *VT*; *Ns*, *Csc*, *Hp*
35. Tammisaari (U) 12. VI, *KR*; *Ns*
36. Kalanti (V) 12. VI, *VT*; *Ns*, *Cl*
37. Aura (V) 13. VI, *VT*; *Ns*, *Hp*
38. Aura (V) 13. VI, *R*; —
39. Aura (V) 13. VI, *VT*; *Ns*, *Cs*
40. Nauvo (V) 12. VI, *R*; —
41. Paimio (V) 14. VI, *VT*; *Ns*
42. Halikko (V) 14. VI, *VT*; *Ns*
43. Mänttä (EH) 14. VI, *VT*; —
44. Mänttä (EH) 14. VI, *R*; *Np*
45. Miehikkälä (EK) 12. VI, *VT*; *Ns*
46. Espoo (U) 13. VI, *VT*; *Ns*, *Csc*, *Hp*
47. Sauvo (V) 13. VI, *VT*; —
48. Aura (V) 13. VI, *VT*; —
49. Koskenpää (EH) 16. VI, *VT*; —
50. Koskenpää (EH) 15. VI, *HSR*; *Np*
51. Koskenpää (EH) 16. VI, *IR*; *Np*
52. Merikarvia (St) 11. VI, *VT*; *Ns*
53. Laitila (V) 12. VI, *VT*; *Ns*
54. Oulu (PP) 16. VI, *R*; —
55. Mellilä (St) 16. VI, *VT*; —
56. Pöytyä (St) 16. VI, *R*; —
57. Teisko (EH) 16. VI, *VT*; *Ns*, *Cl*
58. Teisko (EH) 16. VI, *VT*; —
59. Teisko (EH) 16. VI, *VT*; *Ns*
60. Pattijoki (KP) 6. VI, *VT*; *Ns*, *Hp*
61. Pyhäjoki (KP) 7. VI, *VT*; —
62. Alavieska (KP) 14. VI, *VT*; *Ns*
63. Hinnerjoki (St) 16. VI, *VT*; *Ns*, *Hp*
64. Miehikkälä (EK) 16. VI, *VT*; —
65. Miehikkälä (EK) 17. VI, *KR*; *Ns*
66. Karjaa (V) 17. VI, *VT*; *Np*, *Ns*
67. Karjaa (V) 12. VI, *VT*; *Np*, *Ns*
68. Petäjävesi (PH) 18. VI, *VT*; *Ns*, *Hp*
69. Petäjävesi (PH) 18. VI, *VT*; —
70. Hinnerjoki (St) 18. VI, *VT*; *Ns*
71. Hinnerjoki (St) 18. VI, *KgR*; *Ns*, *Nh*
72. Eura (St) 19. VI, *VT*; *Ns*, *Hp*
73. Eura (St) 19. VI, *VT*; *Ns*
74. Karjalohja (V) 19. VI, *KR*; —
75. Karjalohja (V) 19. VI, *R*; *Np*
76. Kajaani (Kn) 15. VI, *VT*; *Ns*, *Hp*
77. Sotkamo (Kn) 9. VI, *KR*; *Np*
78. Kajaani (Kn) 15. VI, *VT*; —
79. Hinnerjoki (St) 18. VI, *VT*; *Ns*
80. Mänttä (EH) 15. VI, *VT*; —
81. Mänttä (EH) 15. VI, *VT*; *Ns*, *Cl*
82. Koskenpää (EH) 15. VI, *VT*; —
83. Mänttä (EH) 15. VI, *VT*; *Ns*
84. Koskenpää (EH) 15. VI, *IR*; —
85. Turku (V) 17. VI, *VT*; —
86. Nurmijärvi (U) 21. VI, *VT*; *Ns*
87. Kannus (KP) 19. VI, *VT*; *Ns*
88. Kannus (KP) 19. VI, *VT*; —
89. Kannus (KP) 19. VI, *VT*; *Ns*
90. Kannus (KP) 18. VI, *VT*; —
91. Alavieska (KP) 15. VI, *VT*; —
92. Metsämaa (St) 21. VI, *R*; *Np*
93. Rantsila (KP) 20. VI, *VT*; *Ns*
94. Ylämaa (EK) 20. VI, *VT*; *Ns*
95. Metsämaa (St) 21. VI, *VT*; *Ns*
96. Miehikkälä (EK) 19. VI, *IR*; *Np*, *Cl*
97. Rantsila (KP) 20. VI, *VT*; —
98. Miehikkälä (EK) 19. VI, *VT*; —
99. Loimaa (St) 21. VI, *VT*; *Ns*, *Hp*
100. Rantsila (KP) 20. VI, *VT*; —
101. Petäjävesi (PH) 21. VI, *VT*; *Ns*
102. Karkku (St) 20. VI, *VT*; *Ns*, *Hp*
103. Tampere (EH) 25. VI, *VT*; *Ns*
104. Karkku (St) 25. VI, *VT*; *Ns*, *Cl*
105. Humppila (St) 23. VI, *VT*; *Hp*
106. Humppila (St) 23. VI; *VT*; *Ns*

107. Urjala (St) 23. VI, *R*; —
108. Ilomantsi (PK) 17. VI, *IR*; *Np*, *Cl*
109. Ilomantsi (PK) 19. VI, *IR*; *Np*
110. Ilomantsi (PK) 20. VI, *IR*; *Np*, *Hp*, *Cl*
111. Ilomantsi (PK) 22. VI, *VT*; *Hp*
112. Ilomantsi (PK) 22. VI, *VT*; —
113. Ilomantsi (PK) 21. VI, *VT*; *Ns*
114. Ilomantsi (PK) 20. VI, *VT*; *Ns*
115. Ylämaa (EK) 22. VI, *VT*; *Ns*
116. Kokemäki (St) 26. VI, *VT*; *Ns*
117. Köyliö (St) 25. VI, *KgR*; *Np*
118. Jyväskylä (PH) 28. VI, *VT*; —
119. Jalasjärvi (EP) 29. VI, *VT*; —
120. Isojoki (EP) 29. VI, *VT*; *Ns*
121. Tyrvää (St) 29. VI, *VT*; *Ns*
122. Tyrvää (St) 29. VI, *VT*; *Hp*
123. Kannus (KP) 29. VI, *VT*; *Ns*
124. Kannus (KP) 28. VI, *VT*; *Ns*
125. Kiikka (St) 29. VI, *VT*; *Ns*, *Hp*
126. Luumäki (ES) 27. VI, *VT*; *Ns*
127. Lappee (ES) 1. VII, *VT*; *Ns*, *Hp*
128. Haapavesi (KP) 1. VII, *VT*; —
129. Haapavesi (KP) 1. VII, *VT*; *Ns*
130. Vieremä (PS) 1. VII, *R*; *Np*
131. Hanko (U) 1. VII, *VT*; —
132. Hanko (U) 1. VII, *VT*; *Ns*
133. Parkano (St) 2. VII, *VT*; —
134. Parkano (St) 2. VII, *VT*; —
135. Lappee (ES) 1. VII, *KR*; *Np*, *Csc*, *Hp*
136. Sippola (EK) 3. VII, *VT*; —
137. Haapavesi (KP) 2. VII, *VT*; *Ns*
138. Huittinen (St) 3. VII, *VT*; *Ns*
139. Hanko (U) 3. VII, *VT*; *Ns*
140. Hanko (U) 3. VII, *R*; *Np*
141. Suolahti (PH) 2. VII, *VT*; *Ns*
142. Ilomantsi (PK) 30. VI, *IR*; *Np*
143. Ilomantsi (PK) 25. VI, *VT*; —
144. Laukaa (PH) 3. VII, *VT*; *Ns*
145. Laukaa (PH) 3. VII, *VT*; —
146. Suolahti (PH) 3. VII, *VT*; *Hp*
147. Laukaa (PH) 3. VII, *VT*; *Hp*
148. Haapavesi (KP) 3. VII, *VT*; —
149. Lappee (ES) 4. VII, *VT*; *Ns*, *Hp*
150. Luumäki (ES) 4. VII, *VT*; *Csc*
151. Pielisjärvi (PK) 3. VII, *VT*; —
152. Pielisjärvi (PK) 3. VII, *VT*; —
153. Tyrvää (St) 2. VII, *VT*; *Ns*, *Hp*
154. Lieksa (PK) 3. VII, *R*; *Np*, *Hp*
155. Lieksa (PK) 3. VII, *R*; *Np*, *Nh*
156. Iisalmi (PS) 3. VII, *VT*; —
157. Orimattila (U) 5. VII, *VT*; *Ns*
158. Joutseno (ES) 6. VII, *VT*; *Ns*
159. Vampula (St) 6. VII, *VT*; *Ns*, *Hp*
160. Mouhijärvi (St) 3. VII, *VT*; *Ns*
161. Mouhijärvi (St) 3. VII, *VT*; *Ns*
162. Sumiainen (PH) 6. VII, *VT*; *Ns*
163. Jalasjärvi (EP) 4. VII, *VT*; —
164. Sumiainen (PH) 5. VII, *VT*; —
165. Tammela (EH) 6. VII, *VT*; *Ns*
166. Sumiainen (PH) 5. VII, *KR*; *Np*
167. Sumiainen (PH) 5. VII, *VT*; *Ns*
168. Tammela (EH) 6. VII, *VT*; *Ns*
169. Suolahti (PH) 5. VII, *VT*; *Ns*
170. Sumiainen (PH) 5. VII, *VT*; *Ns*, *Hp*
171. Lappee (ES) 4. VII, *VT*; *Ns*
172. Alaveteli (KP) 4. VII, *VT*; *Ns*
173. Alaveteli (KP) 4. VII, *KgR*; —
174. Kälviä (KP) 3. VII, *VT*; *Ns*
175. Vihti (V) 2. VII, *VT*; *Ns*, *Hp*
176. Haapavesi (KP) 7. VII, *R*; —
177. Luumäki (ES) 7. VII, *VT*; *Ns*
178. Mouhijärvi (St) 8. VII, *VT*; *Ns*, *Hp*
179. Kalvola (EH) 9. VII, *KR*; *Ns*, *Cl*
180. Konnevesi (PH) 9. VII, *VT*; —
181. Sahalahti (EH) 9. VII, *VT*; *Ns*, *Hp*
182. Kangasala (EH) 9. VII, *VT*; *Ns*, *Hp*
183. Kangasala (EH) 9. VII, *R*; *Np*
184. Konnevesi (PH) 9. VII, *VT*; —
185. Konnevesi (PH) 9. VII, *VT*; —
186. Eno (PK) 6. VII, *RTR*; *Np*
187. Eno (PK) 6. VII, *VT*; —
188. Eno (PK) 6. VII, *KR*; —
189. Eno (PK) 7. VII, *VT*; —
190. Eno (PK) 7. VII, *KR*; —
191. Sumiainen (PH) 9. VII, *VT*; —
192. Kangasala (EH) 9. VII, *VT*; *Ns*
193. Kangasala (EH) 9. VII, *R*; —
194. Eno (PK) 2. VII, *VT*; —
195. Eno (PK) 3. VII, *VT*; —
196. Eno (PK) 4. VII, *KR*; —
197. Ylivieska (KP) 10. VII, *VT*; *Ns*
198. Kiuruvesi (PS) 7. VII, *R*; *Np*
199. Luumäki (ES) 10. VII, *VT*; *Ns*, *Hp*
200. Vehkalahti (EK) 9. VII, *KR*; *Np*
201. Kruunupyy (KP) 6. VII, *VT*; —
202. Ähtävä (KP) 9. VII, *VT*; *Ns*, *Csc*, *Hp*
203. Purmo (KP) 10. VII, *VT*; *Ns*
204. Lappee (ES) 11. VII, *TR*; *Np*
205. Viljakkala (St) 10. VII, *VT*; —
206. Eräjärvi (EH) 11. VII, *VT*; *Ns*
207. Eräjärvi (EH) 11. VII, *VT*; *Ns*, *Csc*
208. Jalasjärvi (EP) 7. VII, *KR*; *Np*
209. Joutseno (ES) 13. VII, *VT*; *Ns*
210. Joutseno (ES) 12. VII, *VT*; —
211. Alavus (EP) 11. VII, *VT*; *Ns*
212. Joutseno (ES) 13. VII, *VT*; *Ns*
213. Lappee (ES) 12. VII, *VT*; *Csp*
214. Kalvola (EH) 13. VII, *VT*; *Ns*, *Hp*
215. Kalvola (EH) 13. VII, *VT*; *Ns*, *Hp*
216. Jepua (KP) 12. VII, *VT*; *Ns*
217. Jepua (KP) 13. VII, *VT*; *Cl*
218. Uusikaarlepyy (KP) 13. VII, *KgR*; *Ns*
219. Uusikaarlepyy (KP) 13. VII, *IR*; *Hp*, *Cl*
220. Purmo (KP) 10. VII, *VT*; —
221. Kiihtelysvaara (PK) 10. VII, *IR*; —
222. Kiihtelysvaara (PK) 10. VII, *VT*; —
223. Lemi (ES) 13. VII, *VT*; —
224. Kurikka (EP) 13. VII, *R*; —
225. Viljakkala (St) 12. VII, *R*; —
226. Viljakkala (St) 12. VII, *VT*; —
227. Kuru (EH) 12. VII, *VT*; —
228. Kurikka (EP) 13. VII, *VT*; *Ns*
229. Lemi (ES) 12. VII, *VT*; —
230. Lemi (ES) 11. VII, *VT*; —
231. Viljakkala (St) 12. VII, *VT*; —

232. Kuru (EH) 13. VII, *VT*; —
233. Nastola (EH) 16. VII, *VT*; *Ns*
234. Nastola (EH) 16. VII, *VT*; —
235. Kuru (EH) 13. VII, *VT*; *Hp*
236. Nastola (EH) 16. VII, *R*; *Ns*, *Csc*
237. Lemi (ES) 13. VII, *VT*; *Ns*
238. Lemi (ES) 12. VII, *VT*; —
239. Joutseno (ES) 12. VII, *VT*; *Ns*, *Hp*
240. Pielisjärvi (PK) 14. VII, *VT*; *Ns*, *Hp*
241. Pielisjärvi (PK) 14. VII, *R*; *Np*
242. Pielisjärvi (PK) 11. VII, *VT*; *Ns*
243. Pielisjärvi (PK) 13. VII, *VT*; —
244. Pielisjärvi (PK) 13. VII, *IR*; *Np*, *Hp*
245. Kuru (EH) 14. VII, *VT*; —
246. Nastola (EH) 14. VII, *VT*; —
247. Längelmäki (EH) 16. VII, *VT*; —
248. Eräjärvi (EH) 16. VII, *VT*; *Ns*
249. Kuru (EH) 14. VII, *R*; —
250. Kuru (EH) 13. VII, *VT*: *Ns*
251. Kuru (EH) 15. VII, *VT*; *Hp*
252. Kuortane (EP) 16. VII, *VT*; *Ns*
253. Kuortane (EP) 14. VII, *VT*; *Nh*
254. Taipalsaari (ES) 16. VII, *VT*; —
255. Taipalsaari (ES) 16. VII, *VT*; —
256. Yläne (St) 15. VII, *VT*; *Ns*
257. Yläne (St) 6. VII, *VT*; *Ns*, *Csc*, *Hp*
258. Pielavesi (PS) 16. VII, *VT*; *Csc*
259. Pielavesi (PS) 16. VII, *VT*; —
260. Pielavesi (PS) 11. VII, *VSR*; *Np*
261. Joutseno (ES) 19. VII, *VT*: —
262. Kuru (EH) 17. VII, *VT*; *Hp*
263. Ruokolahti (ES) 19. VII, *VT*; *Ns*, *Nb*, *Csp*
264. Ruokolahti (ES) 17. VII, *VT*; —
265. Ruovesi (EH) 17. VII, *VT*; *Ns*, *Hp*
266. Joutseno (ES) 18. VII, *VT*; *Ns*
267. Sievi (KP) 20. VII, *VT*; —
268. Sievi (KP) 20. VII, *Csc*
269. Pielisjärvi (PK) 16. VII, *VT*; *Hp*
270. Pielisjärvi (PK) 17. VII, *VT*; *Ns*
271. Pielisjärvi (PK) 16. VII, *VT*; —
272. Taipalsaari (ES) 17. VII, *VT*; *Ns*
273. Alajärvi (KP) 19. VII, *VT*; —
274. Alajärvi (KP) 19. VII, *VT*; —
275. Iitti (EH) 21. VII, *VT*; *Ns*, *Hp*
276. Ruovesi (EH) 21. VII, *VT*: *Ns*
277. Ruokolahti (ES) 19. VII, *VT*; —
278. Ruovesi (EH) 21. VII, *VT*; — .
279. Ruovesi (EH) 21. VII, *VT*; —
280. Hausjärvi (EH) 18. VII, *VT*; *Ns*
281. Hausjärvi (EH) 19. VII, *VT*; —
282. Hausjärvi (EH) 18. VII, *VT*; *Ns*
283. Luopioinen (EH) 23. VII, *VT*; —
284. Jämsä (EH) 23. VII, *VT*; *Ns*, *Hp*
285. Jämsä (EH) 23. VII, *VT*; —
286. Längelmäki (EH) 23. VII, *R*; *Np*
287. Längelmäki (EH) 23. VII, *VT*; *Hp*
288. Längelmäki (EH) 23. VII, *VT*; *Ns*
289. Vilppula (EH) 24. VII, *VT*; *Ns*
290. Jämsä (EH) 23. VII, *VT*; —
291. Jämsä (EH) 23. VII, *VT*; —
292. Mietoinen (V) 23. VII, *VT*; *Ns*, *Hp*
293. Ruokolahti (ES) 21. VII, *VT*; *Ns*
294. Jämsä (EH) 23. VII, *VT*; *Ns*
295. Jämsä (EH) 23. VII, *VT*; *Ns*
296. Pielisjärvi (PK) 20. VII, *R*; —
297. Pielisjärvi (PK) 19. VII, *R*; *Np*, *Hp*
298. Pielisjärvi (PK) 19. VII, *VT*; *Ns*
299. Ruokolahti (ES) 23. VII, *VT*; *Ns*
300. Ruokolahti (ES) 23. VII, *VT*; —
301. Ruokolahti (ES) 23. VII, *VT*; —
302. Ruovesi (EH) 21. VII, *VT*; —
303. Kälviä (KP) 24. VII, *VT*; *Ns*
304. Ullava (KP) 24. VII, *VT*; *Ns*
305. Ullava (KP) 24. VII, *VT*; *Ns*
306. Ullava (KP) 24. VII, *R*; *Cl*
307. Ullava (KP) 24. VII, *R*; *Hp*
308. Ullava (KP) 24. VII, *R*; *Np*
309. Ullava (KP) 24. VII, *R*; —
310. Teisko (EH) 25. VII, *VT*; *Hp*
311. Teisko (EH) 25. VII, *VT*; *Hp*
312. Imatra (ES) 25. VII, *VT*; —
313. Alajärvi (KP) 23. VII, *VT*; —
314. Alajärvi (KP) 23. VII, *VT*; *Hp*
315. Pielisjärvi (PK) 23. VII, *VT*; —
316. Pielisjärvi (PK) 23. VII, *VT*; *Csc*, *Hp*
317. Pielisjärvi (PK) 23. VII, *VT*; —
318. Jaala (EH) 23. VII, *VT*; *Csc*, *Hp*
319. Jaala (EH) 23. VII, *VT*; *Ppc*
320. Jaala (EH) 23. VII, *VT*; *Hp*
321. Jaala (EH) 28. VII, *VT*; —
322. Puumala (ES) 25. VII, *VT*; *Hp*
323. Ruokolahti (ES) 24. VII, *VT*; —
324. Ruokolahti (ES) 24. VII, *VT*; *Hp*
325. Kuhmoinen (EH) 27. VII, *VT*; —
326. Kuhmoinen (EH) 27. VII, *VT*; —
327. Rautjärvi (ES) 26. VII, *VT*; *Hp*, *Ppc*
328. Rautjärvi (ES) 27. VII, *VT*; —
329. Iitti (EH) 28. VII, *VT*; —
330. Iitti (EH) 28. VII, *VT*; —
331. Rautjärvi (ES) 27. VII, *VT*; —
332. Enonkoski (ES) 27. VII, *VT*; —
333. Enonkoski (ES) 28. VII, *VT*; —
334. Rääkkylä (PK) 20. VII, *VT*; —
335. Savonranta (PS) 23. VII, *KR*; —
336. Enonkoski (ES) 27. VII, *VT*; —
337. Lapinlahti (PS) 30. VII, *R*; *Np*
338. Ilomantsi (PK) 26. VII, *VT*; *Ns*, *Hp*
339. Ilomantsi (PK) 27. VII, *R*; *Np*, *Csc*
340. Pielisjärvi (PK) 26. VII, *VT*; *Ns*, *Hp*
341. Pielisjärvi (PK) 26. VII, *VT*; —
342. Ilomantsi (PK) 27. VII, *VT*; —
343. Ilomantsi (PK) 27. VII, *VT*; *Hp*
344. Ilomantsi (PK) 27. VII, *VT*; *Ns*, *Hp*
345. Ilomantsi (PK) 27. VII, *VT*; *Ns*
346. Ilomantsi (PK) 26. VII, *VT*; —
347. Viitasaari (PH) 25. VII, *VT*; —
348. Pielisjärvi (PK) 25. VII, *VT*; *Ns*, *Csc*
349. Pielisjärvi (PK) 24. VII, *VT*; *Ns*
350. Pielisjärvi (PK) 24. VII, *VT*; *Ns*
351. Sulkava (ES) 27. VII, *VT*; —
352. Korpilahti (EH) 24. VII, *VT*; —
353. Korpilahti (EH) 25. VII, *VT*; *Ns*
354. Vöyri (EP) 20. VII, *VT*; *Ns*, *Hp*
355. Varpaisjärvi (PS) 2. VIII, *R*; —
356. Hollola (EH) 27. VII, *VT*; *Ns*
357. Kärkölä (EH) 25. VII, *VT*; *Ns*
358. Kärkölä (EH) 25. VII, *VT*; —

359. Kärkölä (EH) 23. VII, *VT*; *Ns*
360. Punkaharju (ES) 2. VIII, *VT*; —
361. Multia (PH) 4. VIII, *VT*; *Hp*
362. Kortesjärvi (KP) 5. VIII, *VT*; *Ns*
363. Kannonkoski (PH) 4. VIII, *KR*; *Np*
364. Viitasaari (PH) 1. VIII, *VT*; —
365. Kannonkoski (PH) 2. VIII, *VT*; *Ns*
366. Viitasaari (PH) 1. VIII, *VT*; *Ns*
367. Valkeala (ES) 4. VIII, *VT*; —
368. Valkeala (ES) 4. VIII, *VT*; *Ns*, *Ppe*
369. Kortesjärvi (KP) 5. VIII, *VT*; —
370. Kortesjärvi (KP) 5. VIII, *VT*; *Ns*, *Hp*
371. Keuruu (PH) 3. VIII, *VT*; —
372. Keuruu (PH) 2. VIII, *R*; *Np*
373. Keuruu (PH) 3. VIII, *R*; *Np*
374. Sääminki (ES) 31. VII, *VT*; *Ns*
375. Luhanka (EH) 4. VIII, *VT*; *Ns*
376. Alajärvi (KP) 25. VII, *VT*; *Ns*
377. Alajärvi (KP) 26. VII, *VT*; *Nb*
378. Alajärvi (KP) 30. VII, *VT*; *Ns*
379. Perho (KP) 1. VIII, *VT*; —
380. Perho (KP) 2. VIII, *VT*; *Ns*
381. Alajärvi (KP) 30. VII, *VT*; *Ns*
382. Varpaisjärvi (PS) 5. VIII, *VT*; *Csc*, *Hp*
383. Eno (PK) 4. VIII, *R*; *Csc*
384. Eno (PK) 4. VIII, *R*; *Np*, *Hp*
385. Eno (PK) 2. VIII, *VT*; —
386. Eno (PK) 4. VIII, *VT*; *Ns*
387. Varpaisjärvi (PS) 3. VIII, *VT*; *Hp*
388. Rautavaara (PK) 3. VIII, *R*; *Csc*, *Hp*
389. Perho (KP) 5. VIII, *VT*; *Ns*
390. Perho (KP) 6. VIII, *VT*; —
391. Leivonmäki (ES) 9. VIII, *VT*; *Ns*
392. Luhanka (EH) 9. VIII, *VT*; —
393. Kauhava (KP) 8. VIII, *VT*; *Ns*
394. Multia (PH) 7. VIII, *VT*; *Hp*
395. Kauhava (KP) 9. VIII, *VT*; *Hp*
396. Kauhava (KP) 9. VIII, *VT*; *Ns*
397. Somero (EH) 11. VIII, *VT*; *Ns*, *Hp*
398. Multia (PH) 10. VIII, *VT*; —
399. Multia (PH) 9. VIII, *VT*; *Ns*
400. Mikkeli (ES) 12. VIII, *VT*; —
401. Rääkkylä (PK) 9. VIII, *R*; —
402. Hankasalmi (PH) 7. VIII, *R*; *Np*
403. Hankasalmi (PH) 8. VIII, *VT*; —
404. Multia (PH) 8. VIII, *VT*; —
405. Rautalampi (PH) 9. VIII, *VT*; *Np*
406. Hankasalmi (PH) 8. VIII, *VT*; —
407. Kiikala (V) 10. VIII, *VT*; —
408. Somero (EH) 11. VIII, *VT*; *Ns*
409. Kiikala (V) 10. VIII, *VT*; *Ns*, *Hp*, *Ppe*
410. Kiikala (V) 10. VIII, *VT*; *Ns*
411. Leivonmäki (ES) 11. VIII, *VT*; —
412. Leivonmäki (ES) 11. VIII, *VT*; —
413. Uukuniemi (LK) 11. VIII, *R*; *Np*
414. Uukuniemi (LK) 14. VIII, *VT*; —
415. Uukuniemi (LK) 14. VIII, *VT*; —
416. Uukuniemi (LK) 13. VIII, *VT*; *Ns*, *Hp*
417. Uukuniemi (LK) 14. VIII, *VT*; —
418. Uukuniemi (LK) 11. VIII, *KR*; *Ns*, *Ppe*
419. Rautavaara (PK) 16. VIII, *KR*; *Np*, *Hp*
420. Rautavaara (PK) 16. VIII, *VT*; *Ns*
421. Rautavaara (PK) 16. VIII, *VT*; *Ns*, *Hp*
422. Rautavaara (PK) 16. VIII, *VT*; *Ns*, *Hp*
423. Rautavaara (PK) 16. VIII, *VT*; *Ns*, *Hp*
424. Kangasniemi (ES) 18. VIII, *VT*; *Ns*, *Hp*
425. Leivonmäki (ES) 18. VIII, *VT*; *Ns*
426. Saarijärvi (PH) 14. VIII, *VT*; *Ns*
427. Saarijärvi (PH) 14. VIII, *VT*; *Hp*
428. Äänekoski (PH) 15. VIII, *VT*; —
429. Äänekoski (PH) 16. VIII, *VT*; —
430. Äänekoski (PH) 15. VIII, *VT*; —
431. Konginkangas (PH) 17. VIII, *VT*; —
432. Konginkangas (PH) 18. VIII, *VT*; —
433. Saarijärvi (PH) 17. VIII, *VT*; —
434. Multia (PH) 18. VIII, *VT*; *Ns*, *Nh*
435. Kangasniemi (ES) 18. VIII, *VT*; *Ns*
436. Anttola (ES) 18. VIII, *VT*; *Ns*
437. Anttola (ES) 18. VIII, *R*; —
438. Rääkkylä (PK) 14. VIII, *VT*; *Ns*
439. Rääkkylä (PK) 14. VIII, *VT*; —
440. Mustasaari (EP) 13. VIII, *VT*; *Ns*
441. Kalajoki (KP) 18. VIII, *VT*; *Ns*
442. Kalajoki (KP) 17. VIII, *VT*; *Ns*
443. Karttula (PS) 18. VIII, *VT*; *Ns*
444. Karttula (PS) 18. VIII, *VT*; *Ns*
445. Karttula (PS) 18. VIII, *R*; *Np*
446. Karttula (PS) 17. VIII, *VT*; *Ns*
447. Karttula (PS) 16. VIII, *R*; —
448. Karttula (PS) 16. VIII, *VT*; *Ns*, *Hp*, *Cl*
449. Suonenjoki (PS) 15. VIII, *VT*; —
450. Suonenjoki (PS) 15. VIII, *VT*; —
451. Kitee (PK) 16. VIII, *R*; —
452. Kitee (PK) 21. VIII, *VT*; *Ns*, *Hp*
453. Kitee (PK) 21. VIII, *VT*; *Ns*
454. Kitee (PK) 21. VIII, *VT*; *Ns*, *Hp*
455. Kitee (PK) 21. VIII, *VT*; *Ns*, *Hp*
456. Kitee (PK) 21. VIII, *VT*; —
457. Kitee (PK) 21. VIII, *VT*; *Ns*, *Hp*
458. Kitee (PK) 21. VIII, *VT*; *Ns*
459. Kerimäki (ES) 20. VIII, *VT*; —
460. Kerimäki (ES) 20. VIII, *VT*; —
461. Kerimäki (ES) 17. VIII, *VT*; —
462. Karttula (ES) 17. VIII, *VT*; —
463. Karttula (ES) 17. VIII, *VT*; —
464. Reisjärvi (KP) 21. VIII, *VT*; *Ns*
465. Pihtipudas (PH) 21. VIII, *VT*; —
466. Kangasniemi (ES) 23. VIII, *VT*; *Ns*, *Csp*
467. Kangasniemi (ES) 23. VIII, *VT*; *Ns*
468. Hankasalmi (PH) 21. VIII, *VT*; —
469. Kangasniemi (ES) 23. VIII, *VT*; *Hp*
470. Pielisjärvi (PK) 25. VIII, *IR*; —
471. Joensuu (PK) 26. VIII, *KR*; *Np*, *Ns*
472. Joensuu (PK) 26. VIII, *VT*; —
473. Pyhäjoki (KP) 22. VIII, *VT*; *Hp*
474. Pyhäjoki (KP) 22. VIII, *VT*; *Ns*
475. Viitasaari (PH) 23. VIII, *VT*; —
476. Konginkangas (PH) 21. VIII, *VT*; —

477. Kerimäki (ES) 24. VIII, *VT*; *Ns*
478. Sääminki (ES) 25. VIII, *VT*; —
479. Juva (ES) 23. VIII, *VT*; *Ns*, *Hp*
480. Juva (ES) 25. VIII, *VT*; —
481. Juva (ES) 23. VIII, *IR*; *Np*
482. Loppi (EH) 24. VIII, *VT*; —
483. Juva (ES) 25. VIII, *R*; *Np*
484. Pielisjärvi (PK) 24. VIII, *VT*; —
485. Pieksämäki (PS) 24. VIII, *VT*; —
486. Polvijärvi (PK) 28. VIII, *VT*; *Ns*
487. Polvijärvi (PK) 28. VIII, *VT*; *Ns*
488. Polvijärvi (PK) 29. VIII, *VT*; *Ns*
489. Polvijärvi (PK) 29. VIII, *VT*; *Ns*
490. Pieksämäki (PS) 30. VIII, *IR*; —
491. Pielisjärvi (PK) 31. VIII, *KgR*; *Np*
492. Pieksämäki (PS) 30. VIII, *VT*; *Ns*
493. Haapajärvi (KP) 25. VIII, *VT*; *Ns*, *Hp*
494. Haapajärvi (KP) 25. VIII, *VT*; *Ns*
495. Pielisjärvi (PK) 28. VIII, *VT*; *Ns*
496. Pieksämäki (PS) 30. VIII, *VT*; *Ns*
497. Sääminki (ES) 28. VIII, *VT*; —
498. Sääminki (ES) 27. VIII, *VT*; —
499. Nilsiä (PS) 4. IX, *VT*; —
500. Nilsiä (PS) 4. IX, *VT*; —
501. Nilsiä (PS) 4. IX, *VT*; —
502. Nilsiä (PS) 4. IX, *R*; —
503. Puumala (ES) 6. IX, *VT*; *Ns*
504. Puumala (ES) 6. IX, *R*; *Np*
505. Pattijoki (KP) 29. VIII, *VT*; *Ns*, *Hp*
506. Pattijoki (KP) 28. VIII, *KgR*; *Hp*, *Nh*
507. Puumala (ES) 5. IX, *VT*; *Ns*
508. Kangaslampi (PS) 17. IX, *IR*; —
509. Kangaslampi (PS) 17. IX, *VT*; —
510. Heinävesi (PS) 13. IX, *IR*: *Np*
511. Kangaslampi (PS) 14. IX, *IR*; —
512. Polvijärvi (PK) 13. IX, *IR*: *Np*, *Hp*
513. Sotkamo (Kn) 17. IX, *R*: *Np*
514. Sotkamo (Kn) 17. IX, *VT*; *Nh*
515. Nurmes (PK) 22. IX, *VT*; —
516. Nurmes (PK) 22. IX, *VT*; *Ns*
517. Nurmes (PK) 21. IX, *KgR*; —
518. Nurmes (PK) 20. IX, *R*; *Np*
519. Mäntyharju (ES) 21. IX, *VT*; *Ns*
520. Suomenniemi (ES) 21. IX, *VT*; —
521. Leppävirta (PS) 26. IX, *IR*; —
522. Leppävirta (PS) 26. IX, *VT*: —
523. Kuhmo (Kn) 27. IX, *TR*; *Np*, *Csc*
524. Nurmes (PK) 23. IX, *IR*; —
525. Nakkila (St) 2. X, *KgR*; —
600. Karkku (St) 21. V, *VT*; —
601. Tyrvää (St) 24. V, *VT*; *Ns*, *Hp*
602. Kiikka (St) 25. V, *VT*; —
603. Karkku (St) 20. V, *VT*; —
604. Tyrvää (St) 24. V, *TR*; *Hp*
605. Säkylä (St) 30. V, *VT*; *Ns*, *Hp*
606. Vaasa (EP) 30. V, *VT*; *Ns*
607. Pälkäne (EH) 24. V, *VT*; —
608. Pälkäne (EH) 25. V, *R*; *Np*, *Cl*
609. Pälkäne (EH) 24. V, *VT*; *Ns*
610. Säkylä (St) 30. V, *R*; *Np*, *Cl*
611. Säkylä (St) 30. V, *VT*; —
612. Säkylä (St) 30. V, *VT*; *Ns*
613. Sahalahti (EH) 30. V, *VT*; *Ns*
614. Sahalahti (EH) 30. V, *VT*; *Ns*
615. Sahalahti (EH) 30. V, *VT*; —
616. Pälkäne (EH) 29. V, *VT*; *Ns*
617. Koivulahti (EP) 31. V, *VT*; *Ns*, *Csc*, *Hp*
618. Koivulahti (EP) 31. V, *KgR*; —
619. Pälkäne (EH) 28. V, *VT*; —
620. Pälkäne (EH) 28. V, *VT*; *Ns*
621. Pälkäne (EH) 28. V, *VT*; *Ns*
622. Pälkäne (EH) 28. V, *VT*; —
623. Keuruu (PH) 4. VI, *VT*; *Ns*, *Cl*
624. Heinävesi (PS) 7. VI, *R*; *Np*
625. Heinävesi (PS) 7. VI, *VT*; —
626. Heinävesi (PS) 7. VI, *VT*; *Ns*
627. Kuusjärvi (PK) 7. VI, *VT*; —
628. Heinävesi (PS) 7. VI, *VT*; —
629. Kuusjärvi (PK) 7. VI, *VT*; *Ns*, *Hp*
630. Kuusjärvi (PK) 7. VI, *VT*; *Ns*
631. Heinävesi (PS) 7. VI, *VT*; *Ns*
632. Karjala (V) 6. VI, *VT*; *Ns*
633. Honkilahti (St) 5. VI, *VT*; *Ns*, *Cl*
634. Säkylä (St) 4. VI, *VT*; —
635. Karjala (V) 6. VI, *RR*; *Np*, *Cl*
636. Karjala (V) 6. VI, *VT*; *Ns*, *Hp*
637. Vilppula (EH) 7. VI, *VT*; *Ns*, *Cl*
638. Vilppula (EH) 5. VI, *R*; *Np*
639. Vilppula (EH) 8. VI, *VT*; *Ns*
640. Kuusjärvi (PK) 7. VI, *VT*; —
641. Kuusjärvi (PK) 9. VI, *VT*; —
642. Kuusjärvi (PK) 8. VI, *IR*; —
643. Kuusjärvi (PK) 8. VI, *VT*; —
644. Kuusjärvi (PK) 8. VI, *VT*; *Ns*
645. Kuusjärvi (PK) 9. VI, *VT*; *Ns*
646. Munsala (KP) 9. VI, *RTR*; —
647. Munsala (KP) 9. VI, *R*; —
648. Vehmaa (V) 10. VI, *VT*; *Ns*, *Hp*
649. Karjala (V) 7. VI, *VT*; *Ns*, *Csc*
650. Mynämäki (V) 8. VI, *IR*; *Np*
651. Vilppula (EH) 10. VI, *VT*; *Ns*
652. Vilppula (EH) 9. VI, *VT*; —
653. Vilppula (EH) 6. VI, *IR*; *Np*
654. Maksamaa (EP) 5. VI, *VT*; *Cl*
655. Maksamaa (EP) 6. VI, *VT*; *Ns*
656. Kiukainen (St) 5. VI, *R*; *Ns*, *Hp*
657. Kokemäki (St) 6. VI, *VT*; —
658. Munsala (KP) 9. VI, *VT*; *Ns*, *Hp*
659. Kuhmoinen (EH) 7. VI, *VT*; *Ns*
660. Kuhmalahti (EH) 4. VI, *VT*; —
661. Munsala (KP) 10. VI, *VT*; *Hp*
662. Hausjärvi (EH) 8. VI, *VT*; *Ns*, *Hp*
663. Karvia (St) 6. VI, *R*; —
664. Karvia (St) 6. VI, *R*; —
665. Toivakka (PH) 25. V, *R*; *Np*
666. Heinola (EH) 24. V, *VT*: *Ns*
667. Toivakka (PH) 25. V. *VT*: —
668. Sääksmäki (EH) 20. V, *VT*; —
669. Toivakka (PH) 25. V, *VT*; —
670. Ruovesi (EH) 12. VI, *VT*; *Ns*
671. Karvia (St) 6. VI, *R*: —
672. Parkano (St) 8. VI, *R*; *Np*
673. Jalasjärvi (EP) 11. VI, *R*: —
674. Kuivaniemi (PP) 26. VI, *TR*; *Np*
675. Uusikaarlepyy (KP) 27. VI, *VT*; *Ns*
676. Kiikoinen (St) 27. VI, *VT*; —
677. Kiikoinen (St) 28. VI, *VT*; *Ns*

678. Utajärvi (PP) 27. VI, *RTR*; *Np*, *Hp*
679. Utajärvi (PP) 26. VI, *EMT*; —
680. Utajärvi (PP) 26. VI, *EMT*; *Ns*
681. Uusikaarlepyy (KP) 29. VI, *VT*; —
682. Uusikaarlepyy (KP) 29. VI, *VT*; —
683. Pietarsaari (KP) 29. VI, *VT*; —
684. Ristijärvi (Kn) 30. VI, *IR*; *Np*
685. Ristijärvi (Kn) 30. VI, *KR*; —
686. Kuivaniemi (PP) 28. VI, *EMT*; *Hp*
687. Kuivaniemi (PP) 28. VI, *KgR*; —
688. Kuivaniemi (PP) 29. VI, *KgR*; *Np*
689. Puolanka (Kn) 1. VII, *KR*; *Np*
690. Puolanka (Kn) 28. VI, *RR*; *Np*
691. Puolanka (Kn) 30. VI, *KgR*; —
692. Puolanka (Kn) 28. VI, *RR*; *Np*
693. Paltamo (Kn) 27. VI, *KgR*; —
694. Paltamo (Kn) 27. VI, *IR*; *Cl*
695. Paltamo (Kn) 27. VI, *IR*; *Np*
696. Paltamo (Kn) 26. VI, *VT*; *Ns*
697. Paltamo (Kn) 30. VI, *IR*; *Np*
698. Utajärvi (PP) 30. VI, *EMT*; *Ns*, *Hp*
699. Utajärvi (PP) 28. VI, *KgR*; *Hp*
700. Utajärvi (PP) 29. VI, *IR*; *Np*
701. Utajärvi (PP) 30. VI, *EMT*; *Hp*
702. Utajärvi (PP) 30. VI, *EMT*; —
703. Ristijärvi (Kn) 30. VI, *TR*; —
704. Muhos (PP) 2. VII, *KgR*; —
705. Temmes (PP) 3. VII, *EMT*; —
706. Utajärvi (PP) 1. VII, *EMT*; —
707. Hyrynsalmi (Kn) 4. VII, *TR*; *Np*
708. Ristijärvi (Kn) 1. VII, *EMT*, *Ns*
709. Hyrynsalmi (Kn) 4. VII, *RTR*; —
710. Pello (PP) 3. VII, *EMT*; —
711. Simo (PP) 3. VII, *KgR*; *Np*
712. Simo (PP) 2. VII, *KgR*L *Np*, *Cl*
713. Ranua (PP) 5. VII, *KgR*; *Np*
714. Ranua (PP) 5. VII, *KgR*; *Np*
715. Ranua (PP) 5. VII, *KgR*; *Np*, *Nb*
716. Tervola (PP) 5. VII, *R*; *Np*
717. Suodenniemi (St) 29. VI, *HSR*; —
718. Suodenniemi (St) 30. VI, *IR*; *Np*
719. Hämeenkyrö (St) 3. VII, *VT*; *Ns*, *Hp*, *Cl*
720. Sund (A) 4. VII, *VT*; *Ns*
721. Saltvik (A) 5. VII, *VT*; *Ns*
722. Sund (A) 4. VII, *VT*; —
723. Pello (PP) 7. VII, *VT*; *Hp*
724. Jomala (A) 2. VII, *VT*; *Ns*, *Nh*
725. Sund (A) 4. VII, *VT*; —
726. Pudasjärvi (PP) 4. VII, *HSR*; *Np*
727. Taivalkoski (Ks) 6. VII, *KgR*; *Np*, *Cl*
728. Taivalkoski (Ks) 7. VII, *KgR*; —
729. Taivalkoski (Ks) 4. VII, *KgR*; —
730. Taivalkoski (Ks) 5. VII, *KgR*; —
731. Ylitornio (PP) 1. VII, *R*; *Np*
732. Ylitornio (PP) 2. VII, *HSR*; —
733. Ylitornio (PP) 2. VII, *R*; —
734. Puolanka (Kn) 4. VII, *IR*; *Np*
735. Tervola (PP) 8. VII, *R*; *Np*
736. Tervola (PP) 8. VII, *R*; *Np*
737. Tyrnävä (PP) 5. VII, *KR*; —
738. Tyrnävä (PP) 6. VII, *IR*; —
739. Tyrnävä (PP) 7. VII, *KR*; *Np*
740. Tyrnävä (PP) 7. VII, *KR*; —
741. Muhos (PP) 8. VII, *EMT*; —
742. Puolanka (Kn) 6. VII, *EMT*; —
743. Ikaalinen (St) 7. VII, *IR*; —
744. Ikaalinen (St) 8. VII, *VT*; —
745. Ikaalinen (St) 7. VII, *VT*; *Ns*
746. Ikaalinen (St) 8. VII, *VT*; *Ns*
747. Hyrynsalmi (Kn) 8. VII, *KgR*; —
748. Hyrynsalmi (Kn) 6. VII, *EMT*
749. Hyrynsalmi (Kn) 7. VII, *KR*; *Np*
750. Hyrynsalmi (Kn) 6. VII, *KR*; *Np*
751. Tervola (PP) 5. VII, *VSR*; *Np*
752. Tervola (PP) 7. VII, *EMT*; —
753. Rovaniemi (PP) 9. VII, *EMT*; —
754. Tervola (PP) 5. VII, *EMT*; —
755. Tervola (PP) 7. VII, *EMT*; —
756. Rovaniemi (PP) 9. VII, *EMT*; *Cl*
757. Rovaniemi (PP) 10. VII, *EMT*; *Hp*
758. Tervola (PP) 7. VII, *EMT*; —
759. Ikaalinen (St) 9. VII, *VT*; —
760. Ikaalinen (St) 9. VII, *VT*; *Ppc*
761. Ikaalinen (St) 9. VII, *VSR*; *Np*
762. Ikaalinen (St) 9. VII, *VT*; —
763. Ikaalinen (St) 9. VII, *VT*; *Hp*
764. Ikaalinen (St) 10. VII, *IR*; *Np*, *Csc*
765. Kuru (EH) 10. VII, *R*; *Ns*, *Hp*, *Cl*
766. Suomussalmi (Kn) 10. VII, *KgR*; *Np*
767. Suomussalmi (Kn) 12. VII, *KgR*; *Np*
768. Suomussalmi (Kn) 12. VII, *R*; —
769. Suomussalmi (Kn) 10. VII, *RTR*; *Np*, *Cl*
770. Suomussalmi (Kn) 10. VII, *R*; *Np*
771. Kuru (EH) 11. VII, *VT*; *Ns*
772. Kuru (EH) 12. VII, *VT*; —
773. Kuru (EH) 12. VII, *VT*; —
774. Lohtaja (KP) 12. VII, *VT*; *Hp*
775. Pello (PP) 14. VII, *VT*; —
776. Pello (PP) 14. VII, *VT*; *Cl*
777. Sund (A) 11. VII, *VT*; —
778. Saltvik (A) 7. VII, *VT*; —
779. Saltvik (A) 8. VII, *VT*; —
780. Vårdö (A) 10. VII, *VT*; *Ns*
781. Saltvik (A) 9. VII, *VT*; *Ns*
782. Rovaniemi (PP) 14. VII, *KgR*; —
783. Ranua (PP) 11. VII, *TR*; *Np*
784. Ranua (PP) 10. VII, *KR*; *Np*
785. Hyrynsalmi (Kn) 11. VII, *RTR*; *Np*
786. Hyrynsalmi (Kn) 13. VII, *RTR*; *Np*
787. Hyrynsalmi (Kn) 12. VII, *RTR*; *Ns*, *Hp*
788. Hyrynsalmi (Kn) 8. VII, *RTR*; *Np*, *Hp*
789. Hyrynsalmi (Kn) 7. VII, *TR*; *Hp*
790. Puolanka (Kn) 5. VII, *RTR*; —
791. Hyrynsalmi (Kn) 7. VII, *TR*; *Np*
792. Sund (A) 14. VII, *R*; *Ns*
793. Sund (A) 14. VII, *VT*; *Pc*
794. Sund (A) 14. VII, *VT*; *Ns*
795. Sund (A) 14. VII, *VT*; —
796. Sund (A) 14. VII, *VT*; —
797. Suomussalmi (Kn) 15. VII, *R*; *Np*
798. Suomussalmi (Kn) 14. VII, *R*; *Np*
799. Rovaniemi (PP) 17. VII, *R*; *Hp*
800. Rovaniemi (PP) 17. VII, *R*; *Cl*
801. Suomussalmi (Kn) 14. VII, *R*; *Np*, *Cl*

802. Rovaniemi (PP) 17. VII, *R*; *Cl*
803. Rovaniemi (PP) 17. VII, *EMT*; *Nh*
804. Himanka (KP) 15. VII, *IR*; *Hp*
805. Lohtaja (KP) 14. VII, *VT*; —
806. Rovaniemi (PP) 16. VII, *R*; *Np*
807. Rovaniemi (PP) 18. VII, *R*; —
808. Rovaniemi (PP) 18. VII, *R*; *Cl*
809. Rovaniemi (PP) 18. VII, *R*; —
810. Rovaniemi (PP) 18. VII, *EMT*; —
811. Rovaniemi (PP) 18. VII, *R*; *Np*
812. Rovaniemi (PP) 18. VII, *R*; *Cl*
813. Rovaniemi (PP) 18. VII, *EMT*; —
814. Rovaniemi (PP) 18. VII, *EMT*; —
815. Ylikiiminki (PP) 15. VII, *EMT*; —
816. Ylikiiminki (PP) 14. VII, *EMT*; —
817. Ylikiiminki (PP) 15. VII, *EMT*; *Ns*
818. Ylitornio (PP) 9. VII, *R*; —
819. Ylitornio (PP) 9. VII, *R*; *Np*
820. Ranua (PP) 12. VII, *KR*; —
821. Ranua (PP) 12. VII, *HSR*; —
822. Ranua (PP) 17. VII, *KR*; *Hp*
823. Ranua (PP) 12. VII, *EMT*; —
824. Ylitornio (PP) 11. VII, *EMT*; —
825. Ylitornio (PP) 11. VII, *R*; *Np*, *Hp*
826. Rovaniemi (PP) 13. VII, *R*; *Np*, *Cl*
827. Sund (A) 15. VII, *VT*; *Ns*
828. Sund (A) 15. VII, *VT*; *Ns*
829. Sund (A) 15. VII, *VT*; *Ns*, *Cl*
830. Sund (A) 15. VII, *VT*; *Ns*
831. Jomala (A) 16. VII, *VT*; —
832. Jomala (A) 16. VII, *VT*; *Ns*
833. Sund (A) 16. VII, *VT*; *Ns*
834. Sund (A) 16. VII, *VT*; *Ns*
835. Jomala (A) 17. VII, *VT*; *Np*
836. Ruovesi (EH) 15. VII, *VT*; *Ns*
837. Virrat (PH) 17. VII, *VT*; *Ns*
838. Suomussalmi (Kn) 18. VII, *TR*; *Np*
839. Pudasjärvi (PP) 20. VII, *EMT*; —
840. Jomala (A) 18. VII, *VT*; *Ns*, *Cl*
841. Jomala (A) 18. VII, *VT*; *Ns*
842. Jomala (A) 18. VII, *VT*; —
843. Jomala (A) 18. VII, *VT*; *Ns*
844. Sodankylä (KemL) 21. VII, *EMT*; —
845. Sodankylä (KemL) 21. VII, *EMT*; —
846. Sodankylä (KemL) 21. VII, *EMT*; *Cl*
847. Sodankylä (KemL) 21. VII, *EMT*; —
848. Karunki (PP) 24. VII, *EMT*; —
849. Karunki (PP) 24. VII, *EMT*; *Hp*
850. Suomussalmi (Kn) 16. VII, *TR*; *Np*
851. Suomussalmi (Kn) 21. VII, *TR*; —
852. Suomussalmi (Kn) 19. VII, *RTR*; *Cl*
853. Suomussalmi (Kn) 15. VII, *EMT*; *Hp*
854. Suomussalmi (Kn) 14. VII, *EMT*; —
855. Suomussalmi (Kn) 21. VII, *RTR*; *Np*, *Cl*
856. Rovaniemi (PP) 19. VII, *EMT*; —
857. Rovaniemi (PP) 17. VII, *EMT*; *Hp*
858. Muhos (PP) 18. VII, *KgR*; —
859. Ylikiiminki (PP) 16. VII, *KgR*; —
860. Lemland (A) 21. VII, *VT*; —
861. Lemland (A) 21. VII, *VT*; —
862. Lemland (A) 21. VII, *VT*; *Ns*
863. Lemland (A) 21. VII, *VT*; —
864. Pyhäjoki (KP) 23. VII, *VT*; *Ns*
865. Rovaniemi (PP) 18. VII, *IR*; *Np*, *Hp*, *Ppc*
866. Kemijärvi (PP) 23. VII, *KgR*; —
867. Kemijärvi (PP) 21. VII, *IR*; *Nb*, *Cl*
868. Rovaniemi (PP) 16. VII, *RTR*; —
869. Rovaniemi (PP) 18. VII, *RTR*; —
870. Suomussalmi (Kn) 17. VII, *LR*; *Np*
871. Suomussalmi (Kn) 26. VII, *TR*; *Np*
872. Suomussalmi (Kn) 23. VII, *IR*; *Np*, *Cl*
873. Suomussalmi (Kn) 16. VII, *KR*; *Np*, *Ns*, *Hp*
874. Suomussalmi (Kn) 23. VII, *KR*; *Np*, *Cl*
875. Suomussalmi (Kn) 21. VII, *IR*; *Np*
876. Suomussalmi (Kn) 23. VII, *LR*; *Np*, *Cl*
877. Suomussalmi (Kn) 17. VII, *TR*; *Np*
878. Kemijärvi (PP) 27. VII, *KgR*; *Np*, *Hp*
879. Kemijärvi (PP) 28. VII, *EMT*; —
880. Kemijärvi (PP) 28. VII, *EMT*; *Nh*
881. Kemijärvi (PP) 29. VII, *HSR*; *Np*, *Cl*
882. Pudasjärvi (PP) 30. VII, *KgR*; —
883. Pudasjärvi (PP) 31. VII, *EMT*; *Ns*, *Cl*
884. Pudasjärvi (PP) 31. VII, *EMT*; —
885. Pudasjärvi (PP) 31. VII, *EMT*; *Cl*
886. Pudasjärvi (PP) 30. VII, *KR*; *Np*
887. Pudasjärvi (PP) 31. VII, *TR*; *Np*, *Hp*, *Cl*
888. Lemland (A) 29. VII, *VT*; *Ns*
889. Lemland (A) 29. VII, *VT*; *Ns*
890. Lemland (A) 29. VII, *VT*; *Ns*
891. Vårdö (A) 31. VII, *VT*; —
892. Vårdö (A) 31. VII, *VT*; —
893. Lemland (A) 30. VII, *VT*; *Ns*
894. Lemland (A) 30. VII, *VT*; *Ns*
895. Vårdö (A) 31. VII, *VT*; *Ns*, *Cl*
896. Vårdö (A) 31. VII, *VT*; —
897. Vårdö (A) 31. VII, *VT*; —
898. Vårdö (A) 31. VII, *VT*; —
899. Suomussalmi (Kn) 29. VII, *RTR*; *Np*
900. Suomussalmi (Kn) 31. VII, *IR*; *Np*, *Hp*
901. Suomussalmi (Kn) 28. VII, *TR*; *Np*
902. Suomussalmi (Kn) 24. VII, *RTR*; *Np*
903. Suomussalmi (Kn) 1. VIII, *KgR*; *Cl*
904. Suomussalmi (Kn) 29. VII, *HSR*; *Np*
905. Kuhmo (Kn) 30. VII, *EMT*; *Ns*
906. Kuhmo (Kn) 30. VII, *KgR*; —
907. Kuhmo (Kn) 29. VII, *EMT*; —
908. Kuhmo (Kn) 29. VII, *EMT*; *Hp*
909. Kuhmo (Kn) 31. VII, *EMT*; *Ns*
910. Kuhmo (Kn) 1. VIII, *KR*; *Np*
911. Kuhmo (Kn) 30. VII, *EMT*; —
912. Suomussalmi (Kn) 30. VII, *R*; *Np*
913. Suomussalmi (Kn) 29. VII, *KgR*; *Np*, *Cl*
914. Suomussalmi (Kn) 30. VII, *VSR*; *Np*, *Cl*
915. Suomussalmi (Kn) 28. VII, *VSR*; *Np*
916. Ähtävä (KP) 2. VIII, *VT*; *Hp*
917. Ähtävä (KP) 2. VIII, *VT*; —
918. Ähtävä (KP) 2. VIII, *VT*; *Ns*
919. Ähtävä (KP) 2. VIII, *VT*; *Ns*, *Cl*

920. Ähtävä (KP) 3. VIII, *VT*; *Hp*
921. Ähtävä (KP) 2. VIII, *VT*; —
922. Purmo (KP) 30. VII, *VT*; —
923. Purmo (KP) 30. VII, *VT*; —
924. Purmo (KP) 1. VIII, *VT*; —
925. Ähtävä (KP) 3. VIII, *VT*; —
926. Rovaniemi (PP) 3. VIII, *R*; —
927. Pudasjärvi (PP) 2. VIII, *EMT*; *Ns*, *Hp*
928. Pudasjärvi (PP) 3. VIII, *TR*; *Np*, *Cl*
929. Pudasjärvi (PP) 2. VIII, *EMT*; *Hp*
930. Pudasjärvi (PP) 3. VIII, *IR*; *Np*
931. Pudasjärvi (PP) 3. VIII, *EMT*; —
932. Pudasjärvi (PP) 3. VIII, *EMT*; —
933. Pudasjärvi (PP) 1. VIII, *IR*; *Hp*
934. Pudasjärvi (PP) 1. VIII, *IR*; —
935. Pudasjärvi (PP) 1. VIII, *R*; *Hp*
936. Pudasjärvi (PP) 1. VIII, *VSR*; *Np*
937. Pudasjärvi (PP) 1. VIII, *IR*; *Hp*
938. Kemijärvi (PP) 31. VII, *EMT*; *Hp*
939. Kemijärvi (PP) 1. VIII, *EMT*; —
940. Kemijärvi (PP) 31. VII, *EMT*; *Hp*
941. Kemijärvi (PP) 2. VIII, *KgR*; —
942. Rovaniemi (PP) 29. VII, *EMT*; *Hp*
943. Rovaniemi (PP) 24. VII, *EMT*; —
944. Rovaniemi (PP) 25. VII, *EMT*; *Hp*
945. Rovaniemi (PP) 24. VII, *EMT*; *Hp*
946. Rovaniemi (PP) 24. VII, *KR*; *Np*, *Hp*
947. Kemijärvi (PP) 31. VII, *EMT*; —
948. Vårdö (A) 2. VIII, *VT*; *Ns*
949. Vårdö (A) 1. VIII, *VT*; *Ns*
950. Vårdö (A) 2. VIII, *VT*; *Ns*
951. Vårdö (A) 3. VIII, *VT*; *Ns*
952. Kaustinen (KP) 4. VIII, *VT*; —
953. Kruununpyy (KP) 4. VIII, *VT*; *Hp*
954. Alaveteli (KP) 5. VIII, *VT*; *Ns*
955. Kruunupyy (KP) 4. VIII, *VT*; *Ns*
956. Alaveteli (KP) *VT*; *Hp*
957. Kemi (PP) 5. VIII, *EMT*; —
958. Kemi (PP) 5. VIII, *EMT*; —
959. Pyhäjoki (KP) 1. VIII, *VT*; —
960. Pudasjärvi (PP) 4. VIII, *VSR*; —
961. Pudasjärvi (PP) 6. VIII, *KgR*; —
962. Pudasjärvi (PP) 6. VIII, *EMT*; *Hp*
963. Pudasjärvi (PP) 4. VIII, *VSR*; —
964. Pudasjärvi (PP) 5. VIII, *EMT*; —
965. Kuhmo (Kn) 1. VIII, *EMT*; *Ns*, *Cl*
966. Kuhmo (Kn) 3. VIII, *EMT*; —
967. Kuhmo (Kn) 3. VIII, *KgR*: *Ns*
968. Rovaniemi (PP) 1. VIII, *EMT*; —
969. Rovaniemi (PP) 4. VIII, *HSR*; *Np*
970. Rovaniemi (PP) 30. VII, *HSR*; *Np*
971. Rovaniemi (PP) 30. VII, *KgR*; —
972. Vårdö (A) 4. VIII, *VT*; *Ns*
973. Vårdö (A) 4. VIII, *VT*; *Ns*
974. Vårdö (A) 5. VIII, *VT*: —
975. Lumparland (A) 7. VIII, *VT*; *Ns*
976. Lumparland (A) 7. VIII, *VT*; *Ns*
977. Lumparland (A) 7. VIII, *VT*: —
978. Lumparland (A) 7. VIII, *VT*; *Ns*, *Cl*
979. Suomussalmi (Kn) 3. VIII, *R*: *Np*
980. Suomussalmi (Kn) 4. VIII, *KgR*; *Np*
981. Hyrynsalmi (Kn) 6. VIII, *TR*; *Np*
982. Suomussalmi (Kn) 6. VIII, *IR*; *Np*
983. Hyrynsalmi (Kn) 6. VIII, *IR*; *Np*
984. Hyrynsalmi (Kn) 6. VIII, *KgR*; *Np*
985. Hyrynsalmi (Kn) 6. VIII, *IR*; *Np*
986. Suomussalmi (Kn) 5. VIII, *TR*; *Np*
987. Suomussalmi (Kn) 4. VIII, *RR*; *Np*
988. Paavola (KP) 8. VIII, *KgR*; —
989. Liminka (PP) 10. VIII, *VT*; *Hp*
990. Kuhmo (Kn) 8. VIII, *VT*; *Ns*
991. Kuhmo (Kn) 8. VIII, *VT*; —
992. Kuhmo (Kn) 8. VIII, *VT*; *Ns*
993. Kuhmo (Kn) 8. VIII, *VT*; *Ns*
994. Kuhmo (Kn) 10. VIII, *EMT*; *Hp*
995. Kuhmo (Kn) 10. VIII, *EMT*; *Ns*, *Hp*
996. Kuhmo (Kn) 10. VIII, *VT*; *Ns*, *Cl*
997. Kuhmo (Kn) 8. VIII, *VT*; —
998. Valtimo (PK) 11. VIII, *VT*; *Ns*, *Hp*
999. Sotkamo (Kn) 11. VIII, *VT*; *Ns*, *Hp*
1000. Valtimo (PK) 11. VIII, *VT*; *Ns*
1001. Lemland (A) 10. VIII, *VT*; *Ns*
1002. Lemland (A) 10. VIII, *VT*; —
1003. Lemland (A) 10. VIII, *VT*; *Ns*
1004. Lemland (A) 9. VIII, *VT*; *Ns*
1005. Lemland (A) 10. VIII, *VT*; *Ns*
1006. Lemland (A) 10. VIII, *VT*; —
1007. Rovaniemi (PP) 8. VIII, *HSR*; *Np*
1008. Rovaniemi (PP) 8. VIII, *HSR*; —
1009. Rovaniemi (PP) 8. VIII, *KgR*; —
1010. Rovaniemi (PP) 8. VIII, *KgR*; *Hp*
1011. Pudasjärvi (PP) 10. VIII, *VSR*; *Np*
1012. Taivalkoski (Ks) 10. VIII, *EMT*; *Ns*, *Hp*
1013. Taivalkoski (Ks) 10. VIII, *EMT*; *Hp*
1014. Taivalkoski (Ks) 10. VIII, *EMT*; —
1015. Taivalkoski (Ks) 11. VIII, *EMT*; —
1016. Taivalkoski (Ks) 11. VIII, *EMT*; *Ns*
1017. Taivalkoski (Ks) 12. VIII, *EMT*; —
1018. Taivalkoski (Ks) 10. VIII, *EMT*; *Ns*
1019. Pudasjärvi (PP) 8. VIII, *EMT*; —
1020. Pudasjärvi (PP) 9. VIII, *EMT*; *Ns*, *Hp*, *Csp*
1021. Pudasjärvi (PP) 8. VIII, *EMT*; —
1022. Pudasjärvi (PP) 7. VIII, *EMT*; *Hp*
1023. Pudasjärvi (PP) 9. VIII, *EMT*; —
1024. Pudasjärvi (PP) 8. VIII, *EMT*; *Hp*
1025. Pudasjärvi (PP) 8. VIII, *EMT*; —
1026. Pudasjärvi (PP) 10. VIII, *EMT*; *Hp*
1027. Ullava (KP) 7. VIII, *VT*; —
1028. Sievi (KP) 12. VIII. *VT*; *Ns*, *Hp*
1029. Alaveteli (KP) 6. VIII, *VT*; *Ns*
1030. Sievi (KP) 13. VIII, *VT*; —
1031. Sievi (KP) 11. VIII, *VT*; *Ns*
1032. Paltamo (Kn) 17. VIII, *LR*; *Np*
1033. Hyrynsalmi (Kn) 10. VIII, *IR*; *Np*
1034. Hyrynsalmi (Kn) 10. VIII, *KR*; —
1035. Säräisniemi (Kn) 17. VIII, *IR*; —
1036. Säräisniemi (Kn) 17. VIII, *RR*; —
1037. Utajärvi (PP) 11. VIII, *RTR*; —
1038. Utajärvi (PP) 10. VIII, *RTR*; —
1039. Utajärvi (PP) 11. VIII, *VT*; —
1040. Utajärvi (PP) 6. VIII, *VT*: *Ns*
1041. Muhos (PP) 8. VIII, *HSR*; *Np*
1042. Utajärvi (PP) 14. VIII, *IR*; —
1043. Utajärvi (PP) 13. VIII, *KgR*; —
1044. Kuhmo (Kn) 16. VIII, *EMT*; *Hp*
1045. Kuhmo (Kn) 16. VIII, *EMT*; —

1046. Kuhmo (Kn) 13. VIII, *EMT*; —
1047. Kuhmo (Kn) 15. VIII, *EMT*; —
1048. Kuhmo (Kn) 15. VIII, *EMT*; *Ns*
1049. Kuhmo (Kn) 14. VIII, *IR*; —
1050. Kuhmo (Kn) 11. VIII, *VSR*; *Np*, *Nh*
1051. Kuhmo (Kn) 9. VIII, *VSR*; *Ns*
1052. Kuhmo (Kn) 12. VIII, *VSR*; *Np*
1053. Kuhmo (Kn) 12. VIII, *EMT*; *Hp*, *Nh*
1054. Kuhmo (Kn) 12. VIII, *KR*; —
1055. Kuhmo (Kn) 12. VIII, *KR*; —
1056. Kuhmo (Kn) 6. VIII, *VSR*; *Np*, *Hp*
1057. Kuhmo (Kn) 5. VIII, *IR*; *Np*
1058. Oulujoki (PP) 13. VIII, *EMT*; —
1059. Oulujoki (PP) 15. VIII, *EMT*; *Ns*
1060. Lemland (A) 13. VIII, *VT*; —
1061. Lemland (A) 13. VIII, *VT*; *Ns*
1062. Lemland (A) 13. VIII, *R*; *Ns*
1063. Lemland (A) 13. VIII, *R*; —
1064. Lemland (A) 13. VIII, *R*; —
1065. Lemland (A) 12. VIII, *VT*; *Ns*
1066. Lemland (A) 12. VIII, *VT*; *Ns*
1067. Lemland (A) 12. VIII, *VT*; *Ns*
1068. Föglö (A) 15. VIII, *VT*; —
1069. Föglö (A) 15. VIII, *VT*; —
1070. Turtola (PP) 15. VIII, *HSR*; *Np*
1071. Rovaniemi (PP) 9. VIII, *HSR*; *Np*
1072. Kolari (KemL) 12. VIII, *HSR*; *Np*
1073. Suomussalmi (Kn) 14. VIII, *VSR*; *Np*
1074. Kuhmo (Kn) 17. VIII, *RTR*; *Np*
1075. Suomussalmi (Kn) 16. VIII, *VSR*; —
1076. Suomussalmi (Kn) 16. VIII, *RTR*; *Np*, *Hp*
1077. Suomussalmi (Kn) 16. VIII, *VTR*; *Np*
1078. Suomussalmi (Kn) 15. VIII, *RSR*; *Np*
1079. Suomussalmi (Kn) 15. VIII, *HSR*; *Np*
1080. Taivalkoski (Ks) 16. VIII, *EMT*; *Nh*
1081. Taivalkoski (Ks) 16. VIII, *EMT*; —
1082. Taivalkoski (Ks) 17. VIII, *HSR*; *Np*
1083. Taivalkoski (Ks) 14. VIII, *TR*; *Np*
1084. Taivalkoski (Ks) 15. VIII, *VSR*; *Np*
1085. Taivalkoski (Ks) 14. VIII, *EMT*; *Np*
1086. Taivalkoski (Ks) 13. VIII, *EMT*; *Hp*
1087. Taivalkoski (Ks) 13. VIII, *EMT*; *Np*, *Nh*
1088. Taivalkoski (Ks) 14. VIII, *IR*; *Np*
1089. Ylivieska (KP) 15. VIII, *VT*; *Ns*
1090. Oulainen (KP) 17. VIII, *VT*; *Ns*, *Hp*
1091. Oulainen (KP) 17. VIII, *VT*; *Ns*
1092. Ylivieska (KP) 14. VIII, *VT*; *Ns*
1093. Ylivieska (KP) 13. VIII, *VT*; —
1094. Ylivieska (KP) 14. VIII, *VT*; —
1095. Kauhava (KP) 17. VIII, *R*; *Np*, *Cl*
1096. Kuhmo (Kn) 11. VIII, *EMT*; *Ns*
1097. Kuhmo (Kn) 15. VIII, *KR*; *Np*
1098. Kuhmo (Kn) 14. VIII, *RTR*; *Np*
1099. Kuhmo (Kn) 11. VIII, *HSR*; —
1100. Kuhmo (Kn) 16. VIII, *EMT*; —
1101. Kuhmo (Kn) 20. VIII, *EMT*; *Ns*
1102. Kuhmo (Kn) 19. VIII, *EMT*; *Ns*, *Hp*, *Cl*
1103. Kuhmo (Kn) 20. VIII, *HSR*; *Np*
1104. Kuhmo (Kn) 20. VIII, *IR*; *Np*
1105. Kuhmo (Kn) 18. VIII, *EMT*; *Ns*, *Hp*
1106. Kuhmo (Kn) 19. VIII, *EMT*; *Ns*
1107. Kuhmo (Kn) 18. VIII, *KgR*; *Nh*
1108. Kuhmo (Kn) 19. VIII, *KR*; *Np*
1109. Kuhmo (Kn) 19. VIII, *RTR*; *Np*
1110. Kuhmo (Kn) 19. VIII, *RTR*; *Np*
1111. Kuhmo (Kn) 19. VIII, *EMT*; *Ns*
1112. Kuhmo (Kn) 21. VIII, *HSR*; *Np*, *Cl*
1113. Kuhmo (Kn) 21. VIII, *EMT*; *Ns*, *Nh*
1114. Kuhmo (Kn) 21. VIII, *EMT*; *Ns*, *Csc*
1115. Vuolijoki (Kn) 21. VIII, *R*; *Np*
1116. Paltamo (Kn) 18. VIII, *LR*; —
1117. Paltamo (Kn) 18. VIII, *KR*; *Np*
1118. Paltamo (Kn) 18. VIII, *IR*; *Np*
1119. Yli-Ii (PP) 22. VIII, *VT*; —
1120. Kajaani (Kn) 20. VIII, *EMT*; —
1121. Säräisniemi (Kn) 19. VIII, *VSR*; *Np*
1122. Säräisniemi (Kn) 20. VIII, *KgR*; —
1123. Sottunga (A) 20. VIII, *VT*; *Ns*
1124. Sottunga (A) 20. VIII, *VT*; —
1125. Sottunga (A) 21. VIII, *VT*; *Ns*
1126. Föglö (A) 18. VIII, *VT*; *Ns*
1127. Föglö (A) 18. VIII, *VT*; —
1128. Föglö (A) 19. VIII, *VT*; —
1129. Föglö (A) 19. VIII, *R*; *Ns*
1130. Ylikiiminki (PP) 25. VIII, *KgR*; —
1131. Piippola (KP) 25. VIII, *KgR*; —
1132. Piippola (KP) 25. VIII, *HSR*; *Np*
1133. Kortesjärvi (KP) 24. VIII, *R*; *Cl*
1134. Taivalkoski (Ks) 22. VIII, *R*; *Np*
1135. Piippola (KP) 24. VIII, *VT*; —
1136. Piippola (KP) 24. VIII, *VT*; *Ns*, *Hp*
1137. Piippola (KP) 24. VIII, *HSR*; *Np*
1138. Kestilä (KP) 22. VIII, *IR*; *Np*
1139. Kestilä (KP) 22. VIII, *KR*; *Np*, *Ns*
1140. Pyhäntä (KP) 24. VIII, *KR*; *Ns*
1141. Kuhmo (Kn) 22. VIII, *EMT*; —
1142. Kuhmo (Kn) 22. VIII, *KR*; —
1143. Kuhmo (Kn) 23. VIII, *EMT*; —
1144. Kuhmo (Kn) 24. VIII, *VSR*; —
1145. Kuhmo (Kn) 24. VIII, *HSR*; *Np*
1146. Kuhmo (Kn) 24. VIII, *HSR*; *Np*
1147. Kuhmo (Kn) 24. VIII, *HSR*; *Np*
1148. Pudasjärvi (PP) 20. VIII, *HSR*; —
1149. Pudasjärvi (PP) 20. VIII, *KgR*; *Np*
1150. Pudasjärvi (PP) 18. VIII, *HSR*; —
1151. Pudasjärvi (PP) 18. VIII, *VSR*; —
1152. Pudasjärvi (PP) 21. VIII, *RTR*; *Np*
1153. Pudasjärvi (PP) 20. VIII, *HSR*; —
1154. Evijärvi (KP) 24. VIII, *VT*; *Ns*
1155. Piippola (KP) 25. VIII, *RTR*; *Np*
1156. Taivalkoski (Ks) 24. VIII, *RTR*; —
1157. Taivalkoski (Ks) 23. VIII, *TR*; —
1158. Kärsämäki (KP) 27. VIII, *KR*; *Ns*
1159. Piippola (KP) 26. VIII, *EMT*; *Ns*, *Hp*
1160. Kärsämäki (KP) 27. VIII, *KgR*; *Ns*
1161. Kärsämäki (KP) 27. VIII, *R*; *Np*
1162. Piippola (KP) 26. VIII, *VT*; *Ns*, *Hp*
1163. Kärsämäki (KP) 27. VIII, *VT*; *Ns*, *Hp*, *Cl*
1164. Kärsämäki (KP) 26. VIII, *EMT*; *Cl*
1165. Vieremä (PS) 26. VIII, *VT*; —
1166. Vieremä (PS) 27, VII, *VT*; *Ns*, *Cse*, *Hp*
1167. Vieremä (PS) 28. VIII, *VT*; —
1168. Sonkajärvi (PS) 23. VIII, *IR*; *Np*
1169. Vieremä (PS) 28. VIII, *VT*; —

1170. Vieremä (PS) 26. VIII, *VT*; *Ns*, *Hp*
1171. Vieremä (PS) 25. VIII, *IR*; *Np*
1172. Kuhmo (Kn) 20. VIII, *VSR*; *Np*
1173. Kuhmo (Kn) 22. VIII, *TR*; —
1174. Kuhmo (Kn) 22. VIII, *RTR*; —
1175. Kuhmo (Kn) 21. VIII, *RTR*; *Np*, *Ns*
1176. Kuhmo (Kn) 21. VIII, *HSR*; *Np*, *Cl*
1177. Kuhmo (Kn) 26. VIII, *RTR*; *Np*
1178. Kuhmo (Kn) 24. VIII, *VSR*; *Np*
1179. Kuhmo (Kn) 27. VIII, *IR*; *Np*
1180. Kuhmo (Kn) 25. VIII, *EMT*; *Ns*
1181. Kuhmo (Kn) 27. VIII, *RTR*; *Np*, *Cl*
1182. Kuhmo (Kn) 25. VIII, *EMT*; *Hp*
1183. Liminka (PP) 27. VIII, *VT*; *Hp*
1184. Valtimo (PK) 27. VIII, *IR*; *Np*, *Nh*
1[illegible]5. Valtimo (PK) 27. VIII, *VT*; *Hp*
1186. Nurmes (PK) 27. VIII, *KR*; —
1187. Nurmes (PK) 28. VIII, *KR*; *Np*
1188. Nurmes (PK) 25. VIII, *IR*; *Np*
1189. Sotkamo (Kn) 31. VIII, *EMT*; —
1190. Sotkamo (Kn) 29. VIII, *EMT*; —
1191. Sotkamo (Kn) 28. VIII, *VSR*; —
1192. Kiiminki (PP) 31. VIII, *VT*; *Nh*
1193. Vieremä (PS) 29. VIII, *VT*; *Ns*
1194. Renko (EH) 3. IX, *IR*; *Np*
1195. Renko (EH) 3. IX, *VT*; *Ns*
1196. Vanaja (EH) 4. IX, *VT*; —
1197. Vanaja (EH) 4. IX, *VT*; *Ns*, *Hp*
1198. Vanaja (EH) 4. IX, *VT*; *Ns*
1199. Pyhtää (U) 7. IX, *VT*; *Ns*
1200. Pyhtää (U) 6. IX, *VT*; —
1201. Pyhtää (U) 6. IX, *VT*; *Ns*
1202. Pyhtää (U) 6. IX, *VT*; *Ns*
1203. Utajärvi (PP) 2. IX, *R*; *Np*
1204. Säräisniemi (Kn) 4. IX, *R*; *Np*
1205. Utajärvi (PP) 3. IX, *RTR*; *Np*
1206. Utajärvi (PP) 3. IX, *TR*; *Np*
1207. Säräisniemi (Kn) 4. IX, *TR*; *Np*
1208. Säräisniemi (Kn) 4. IX, *RTR*; —
1209. Taivalkoski (Ks) 29. VIII, *KgR*; *Np*
1210. Taivalkoski (Ks) 31. VIII, *KR*; —
1211. Laukaa (PH) 8. IX, *VT*; —
1212. Oulunsalo (PP) 5. IX, *VT*; —
1213. Puolanka (Kn) 6. IX, *EMT*; —
1214. Puolanka (Kn) 6. IX, *HSR*; *Np*
1215. Säräisniemi (Kn) 5. IX, *EMT*; —
1216. Säräisniemi (Kn) 5. IX, *IR*; —
1217. Säräisniemi (Kn) 5. IX, *KgR*; *Np*, *Hp*
1218. Säräisniemi (Kn) 6. IX, *KR*; *Np*
1219. Säräisniemi (Kn) 5. IX, *EMT*; *Ns*
1220. Säräisniemi (Kn) 6. IX, *HSR*; *Np*
1221. Puolanka (Kn) 6. IX, *EMT*; *Hp*
1222. Puolanka (Kn) 10. IX, *EMT*; —
1223. Puolanka (Kn) 10. IX, *R*; *Np*, *Hp*
1224. Puolanka (Kn) 10. IX, *TR*; *Np*
1225. Puolanka (Kn) 9. IX, *IR*; —
1226. Puolanka (Kn) 10. IX, *TR*; —
1227. Puolanka (Kn) 11. IX, *IR*; —
1228. Puolanka (Kn) 10. IX, *EMT*; *Ns*, *Cl*
1229. Hankasalmi (PH) 9. IX, *VT*; *Ns*
1230. Konnevesi (PH) 13. IX, *VT*; *Ns*, *Hp*
1231. Kymi (EK) 10. IX, *VT*; *Ns*
1232. Vehkalahti (EK) 11. IX, *VT*; *Ns*
1233. Vehkalahti (EK) 12. IX, *VT*; —
1234. Vehkalahti (EK) 11. IX, *VT*; *Ns*
1235. Vehkalahti (EK) 12. IX, *VT*; *Ns*
1236. Suomussalmi (Kn) 15. IX, *EMT*; —
1237. Suomussalmi (Kn) 15. IX, *EMT*; —
1238. Suomussalmi (Kn) 14. IX, *EMT*; —
1239. Suomussalmi (Kn) 14. IX, *EMT*; *Ns*
1240. Puolanka (Kn) 13. IX, *HSR*; *Np*
1241. Puolanka (Kn) 13. IX, *RTR*; *Np*
1242. Puolanka (Kn) 14. IX, *EMT*; *Ns*
1243. Suomussalmi (Kn) 14. IX, *EMT*; *Csp*
1244. Pyhäjärvi (O.l.) (Kn) 11. IX, *VT*; *Ns*
1245. Pihtipudas (PH) 11. IX, *KgR*; —
1246. Pihtipudas (PH) 14. IX, *VT*; *Ns*
1247. Pihtipudas (PH) 14. IX, *VT*; —
1248. Pihtipudas (PH) 13. IX, *VT*; —
1249. Pihtipudas (PH) 11. IX, *VT*; *Hp*
1250. Pihtipudas (PH) 15. IX, *VT*; —
1251. Tammela (EH) 9. IX, *R*; *Np*
1252. Tammela (EH) 10. IX, *VT*; —
1253. Tammela (EH) 11. IX, *VT*; *Np*, *Ns*, *Hp*
1254. Renko (EH) 8. IX, *KR*; —
1255. Tammela (EH) 12. IX, *VT*; —
1256. Tammela (EH) 12. IX, *VT*; *Ns*
1257. Somerniemi (EH) 14. IX, *VT*; *Ns*, *Hp*
1258. Tammela (EH) 14. IX, *VT*; *Hp*
1259. Tammela (EH) 14. IX, *IR*; *Ns*
1260. Tammela (EH) 12. IX, *RR*; *Np*
1261. Tammela (EH) 13. IX, *VT*; *Ns*, *Csp*
1262. Viitasaari (PH) 18. IX, *VT*; —
1263. Viitasaari (PH) 17. IX, *VT*; *Ns*
1264. Viitasaari (PH) 16. IX, *VT*; *Ns*
1265. Viitasaari (PH) 21. IX, *VT*; —
1266. Vihti (V) 18. IX, *R*; *Np*
1267. Lemi (ES) 20. IX, *VT*; —
1268. Lappee (ES) 20. IX, *VT*; *Ns*
1269. Lappee (ES) 20. IX, *VT*; *Ns*
1270. Luumäki (ES) 17. IX, *VT*; *Ns*
1271. Vehkalahti (EK) 15. IX, *VT*; *Ns*
1272. Luumäki (ES) 16. IX, *VT*; *Ns*
1273. Luumäki (ES) 18. IX, *VT*; —
1274. Luumäki (ES) 16. IX, *VT*; —
1275. Vehkalahti (EK) 14. IX, *VT*; *Ns*
1276. Luumäki (ES) 17. IX, *VT*; *Ns*
1277. Vehkalahti (EK) 13. IX, *VT*; —
1278. Luumäki (ES) 16. IX, *VT*; *Ns*
1279. Viitasaari (PH) 19. IX, *VT*; *Ns*, *Csc*
1280. Pulkkila (KP) 21. IX, *VT*; —
1281. Kivijärvi (PH) 23. IX, *VT*: —
1282. Karstula (PH) 24. IX, *VT*; *Ns*, *Csc*
1283. Suomussalmi (Kn) 15. IX, *IR*; *Np*
1284. Puolanka (Kn) 13. IX, *EMT*; —
1285. Suomussalmi (Kn) 17. IX, *RTR*; *Np*
1286. Suomussalmi (Kn) 17. IX, *EMT*; —
1287. Suomussalmi (Kn) 20. IX, *EMT*; *Ns*
1288. Suomussalmi (Kn) 17. IX, *KR*; *Np*
1289. Kiikala (V) 17. IX, *VT*; *Ns*
1290. Pertteli (V) 23. IX, *VT*; *Ns*, *Hp*
1291. Uskela (V) 23. IX, *VT*; *Ns*, *Csp*
1292. Pertteli (Kn) 23. IX, *VT*; *Ns*
1293. Somero (EH) 17. IX, *VT*; *Ns*
1294. Uskela (V) 23. IX, *KgR*; —
1295. Uskela (V) 23. IX, *VT*; *Ns*, *Hp*
1296. Uskela (V) 24. IX, *VT*; *Ns*, *Hp*

1297. Uskela (V) 24. IX, *VT*; *Ns*
1298. Uskela (V) 25. IX, *VT*; *Ns*, *Hp*
1299. Angelniemi (V) 26. IX, *VT*; *Ns*, *Hp*
1300. Kemiö (V) 28. IX, *R*; —
1301. Kemiö (V) 27. IX, *VT*; *Ns*, *Csc*
1302. Kemiö (V) 27. IX, *VT*; —
1303. Suomussalmi (Kn) 25. IX, *VSR*; *Np*
1304. Taivalkoski (Ks) 25. IX, *EMT*; *Hp*, *Nh*
1305. Taivalkoski (Ks) 24. IX, *EMT*; *Csp*
1306. Utajärvi (PP) 28. IX, *VT*; —
1307. Mikkeli (ES) 1. X, *VT*; —
1308. Mikkeli (ES) 1. X, *VT*; *Ns*
1309. Kuusamo (Ks) 26. IX, *EMT*; —
1310. Kuusamo (Ks) 27. IX, *EMT*; —
1311. Kuusamo (Ks) 28. IX, *EMT*; —
1312. Kuusamo (Ks) 27. IX, *RR*; *Np*
1313. Kemiö (V) 29. IX, *IR*; *Np*
1314. Dragsfjärd (V) 2. X, *VT*; —
1315. Kemiö (V) 30. IX, *VT*; —
1316. Västanfjärd (V) 2. X, *VT*; *Ns*
1317. Kemiö (V) 30. IX, *KgR*; *Ns*
1318. Kemiö (V) 30. IX, *VT*; *Ns*
1319. Dragsfjärd (V) 3. X, *VT*; —
1320. Karstula (PH) 27. IX, *VT*; *Ns*
1321. Karstula (PH) 29. IX, *VT*; *Ppc*
1322. Karstula (PH) 30. IX, *VT*; *Ns*, *Csc*, *Hp*
1323. Karstula (PH) 29. IX, *VT*; *Hp*
1324. Karstula (PH) 1. X, *IR*; —
1325. Karstula (PH) 30. IX, *VT*; —
1326. Soini (KP) 1. X, *VT*; —
1327. Mikkeli (ES) 4. X, *VT*; *Ns*
1328. Kuopio (PS) 21. IX, *VT*; *Ns*, *Hp*
1329. Närpiö (EP) 21. V, *VT*; *Ns*, *Hp*
1330. Nokia (EH) 22. V, *VT*; *Ns*, *Hp*
1331. Tottijärvi (EH) 21. V, *VT*; *Ns*
1332. Nokia (EH) 22. V, *VT*; *Csc*
1333. Marttila (V) 23. V, *VT*; *Ns*
1334. Merikarvia (St) 20. V, *IR*; *Np*, *Ns*, *Csc*
1335. Merikarvia (St) 19. V, *VT*; *Ns*, *Csp*
1336. Närpiö (EP) 23. V, *VT*; *Ns*
1337. Ylimarkku (EP) 24. V, *IR*; —
1338. Närpiö (EP) 23. V, *VT*; *Ns*, *Cl*
1339. Nokia (EH) 26. V, *VT*; *Ns*
1340. Savitaipale (ES) 28. V, *IR*; *Np*
1341. Savitaipale (ES) 26. V, *VT*; *Ns*, *Hp*
1342. Vöyri (EP) 29. V, *VT*; *Ns*, *Csp*
1343. Vöyri (EP) 28. V, *VT*; *Hp*
1344. Vöyri (EP) 29. V, *VT*; *Nh*
1345. Luvia (St) 30. V, *VT*; *Ns*
1346. Luvia (St) 30. V, *VT*; *Ns*
1347. Luvia (St) 30. V, *VT*; *Ns*, *Nh*
1348. Ruovesi (EH) 30. V, *VT*; *Ns*
1349. Isojoki (EP) 28. V, *RR*; *Np*, *Hp*, *Cl*
1350. Isojoki (EP) 26. V, *VT*; —
1351. Teisko (EH) 29. V, *VT*; *Ns*, *Hp*
1352. Isojoki (EP) 26. V, *RR*; *Np*
1353. Teisko (EH) 31. V, *VT*; *Ns*
1354. Teisko (EH) 1. VI, *VT*; *Ns*
1355. Oravainen (EP) 1. VI, *RR*; *Np*, *Hp*
1356. Vöyri (EP) 31. V, *VT*; —
1357. Puumala (ES) 1. VI, *VT*; —
1358. Puumala (ES) 31. V, *VT*; —
1359. Ruovesi (EH) 28. V, *VT*; *Ns*, *Hp*
1360. Tohmajärvi (PK) 1. VI, *VT*; *Ns*, *Hp*
1361. Kesälahti (PK) 21. V, *VT*; *Ns*
1362. Maaninka (PS) 3. VI, *VT*; —
1363. Lapväärtti (EP) 3. VI, *VT*; *Ns*
1364. Lapväärtti (EP) 3. VI, *VT*; *Ns*
1365. Siipyy (EP) 2. VI, *KR*; —
1366. Lapväärtti (EP) 2. VI, *VT*; *Cl*
1367. Ulvila (St) 4. VI, *VT*; —
1368. Kauhajoki (EP) 2. VI, *VT*; —
1369. Purmo (KP) 4. VI, *VT*; —
1370. Purmo (KP) 4. VI, *VT*; *Ns*
1371. Lapväärtti (EP) 3. VI, *VT*; *Ns*, *Hp*
1372. Lapväärtti (EP) 5. VI, *VT*; *Ns*
1373. Lapväärtti (EP) 4. VI, *VT*; *Ns*
1374. Lapväärtti (EP) 3. VI, *VT*; *Ns*, *Cl*
1375. Kullaa (St) 6. VI, *R*; *Np*
1376. Kullaa (St) 6. VI, *VT*; *Ns*
1377. Ruovesi (EH) 5. VI, *VT*; *Ns*
1378. Vilppula (EH) 5. VI, *VT*; *Hp*
1379. Kangasala (EH) 6. VI, *KgR*; *Ns*, *Cl*
1380. Ähtävä (KP) 5. VI, *IR*; *Hp*, *Cl*
1381. Ähtävä (KP) 6. VI, *VT*; *Csc*, *Hp*
1382. Puumala (ES) 4. VI, *VT*; *Ns*
1383. Puumala (ES) 7. VI, *VT*; —
1384. Alaveteli (KP) 8. VI, *IR*; *Np*
1385. Alaveteli (KP) 8. VI, *VT*; *Hp*, *Cl*
1386. Ruovesi (EH) 2. VI, *VT*; —
1387. Tuupovaara (PK) 5. VI, *VT*; *Ns*, *Hp*
1388. Tuupovaara (PK) 6. VI, *VT*; *Ns*
1389. Korsnäs (EP) 7. VI, *IR*; *Np*, *Hp*
1390. Korsnäs (EP) 8. VI, *KgR*; —
1391. Pyhäselkä (PK) 2. VI, *VT*; *Ns*
1392. Tenhola (V) 2. VI, *VT*; *Ns*
1393. Tenhola (V) 1. VI, *VT*; *Hp*
1394. Tenhola (V) 2. VI, *VT*; *Ns*, *Hp*
1395. Vilppula (EH) 9. VI, *VT*; *Ns*, *Csc*
1396. Kuru (EH) VT; 8. VI, *VT*; *Ns*, *Hp*
1397. Kuru (EH) 5. VI, *VT*; *Ns*, *Hp*
1398. Vilppula (EH) 9. VI, *VT*; *Ns*, *Hp*
1399. Vilppula (EH) 9. VI, *VT*; *Ns*
1400. Vilppula (EH) 9. VI, *VT*; *Ns*
1401. Vilppula (EH) 9. VI, *VT*; *Ns*
1402. Seinäjoki (EP) 10. VI, *RR*; *Np*, *Hp*
1403. Ilmajoki (EP) 10. VI, *VT*; *Ns*
1404. Jämsä (EH) 14. VI, *VT*; *Ns*
1405. Jämsä (EH) 14. VI, *VT*; *Hp*
1406. Kuorevesi (EH) 14. VI, *VT*; *Ns*, *Cl*
1407. Kuorevesi (EH) 14. VI, *VT*; *Hp*
1408. Ilomantsi (PK) 1. VI, *VT*; *Ns*, *Hp*, *Cl*
1409. Ilomantsi (PK) 8. VI, *VT*; *Ns*, *Hp*
1410. Vilppula (EH) 11. VI, *VT*; *Ns*, *Csc*
1411. Jämsä (EH) 14. VI, *IR*; *Np*
1412. Jämijärvi (St) 15. VI, *R*; *Np*, *Cl*
1413. Korsnäs (EP) 9. VI, *IR*; *Cl*
1414. Petolahti (EP) 9. VI, *IR*; *Hp*
1415. Maalahti (EP) 12. VI, *KgR*; —
1416. Korpilahti (EH) 19. VI, *VT*; *Ns*, *Hp*
1417. Koskenpää (EH) 19. VI, *VT*; *Ns*
1418. Koskenpää (EH) 19. VI, *VT*; *Ns*
1419. Korpilahti (EH) 19. VI, *VT*; *Ns*
1420. Koskenpää (EH) 19. VI, *VT*; *Hp*
1421. Jämsä (EH) 19. VI, *VT*; *Ns*
1422. Jämsä (EH) 19. VI, *VT*; *Ns*

1423. Korpilahti (EH) 19. VI, *R*; *Np*
1424. Korpilahti (EH) 19. VI, *R*; *Hp*
1425. Hirvensalmi (EH) 20. VI, *VT*; *Ns*
1426. Korpilahti (EH) 20. VI, *VT*; *Ns*
1427. Korpilahti (EH) 20. VI, *VT*; *Ns*, *Hp*
1428. Korpilahti (EH) 20. VI, *VT*; *Ns*
1429. Ruovesi (EH) 15. VI, *VT*; *Ns*, *Cl*
1430. Mustasaari (EP) 17. VI, *VT*; *Hp*
1431. Ilomantsi (PK) 22. VI, *VT*; —
1432. Kuorevesi (EH) 17. VI, *TR*; *Np*
1433. Längelmäki (EH) 18. VI, *VT*; *Np*, *Ns*, *Hp*
1434. Orivesi (EH) 18. VI, *TR*; *Np*
1435. Kittilä (KemL) 3. VII, *HSR*; *Np*, *Cl*
1436. Kittilä (KemL) 3. VII, *HSR*; *Np*, *Hp*, *Cl*
1437. Muonio (KemL) 3. VII, *EMT*; *Hp*, *Cl*
1438. Pudasjärvi (PP) 5. VII, *EMT*; —
1439. Pudasjärvi (PP) 4. VII, *EMT*; *Cl*
1440. Salla (Ks) 5. VII, *HSR*; *Np*, *Cl*
1441. Muonio (KemL) 5. VII, *EMT*; *Cl*
1442. Muonio (KemL) 5. VII, *EMT*; *Cl*
1443. Muonio (KemL) 5. VII, *EMT*; *Hp*
1444. Kuusamo (Ks) 9. VII, *KgR*; *Np*, *Hp*, *Cl*
1445. Kuusamo (Ks) 9. VII, *KR*; —
1446. Kuusamo (Ks) 6. VII, *TR*; *Np*
1447. Kuusamo (Ks) 5. VII, *LR*; *Np*
1448. Kuusamo (Ks) 3. VII, *LR*; *Np*
1449. Kuusamo (Ks) 3. VII, *TR*; *Np*, *Hp*, *Cl*
1450. Kuusamo (Ks) 4. VII, *RSR*; *Np*
1451. Sodankylä (KemL) 7. VII, *EMT*; *Hp*, *Cl*
1452. Sodankylä (KemL) 8. VII, *TR*; *Np*
1453. Sodankylä (KemL) 8. VII, *EMT*; *Hp*, *Cl*
1454. Sodankylä (KemL) 7. VII, *EMT*; *Cl*
1455. Sodankylä (KemL) 7. VII, *EMT*; *Nh*
1456. Sodankylä (KemL) 7. VII, *RR*; *Np*
1457. Inari (InL) 9. VII, *EMT*; *Hp*
1458. Sodankylä (KemL) 7. VII, *EMT*; *Ht*
1459. Sodankylä (KemL) 7. VII, *EMT*; *Hp*, *Cl*
1460. Kittilä (KemL) 6. VII, *EMT*; *Nh*
1461. Salla (Ks) 10. VII, *EMT*; *Hp*, *Cl*
1462. Kolari (KemL) 7. VII, *EMT*; —
1463. Kolari (KemL) 9. VII, *EMT*; *Nb*, *Cl*, *Nh*
1464. Kolari (KemL) 9. VII, *EMT*; —
1465. Kolari (KemL) 8. VII, *EMT*; —
1466. Savukoski (KemL) 8. VII, *EMT*; *Cl*
1467. Savukoski (KemL) 10. VII, *EMT*; —
1468. Savukoski (KemL) 10. VII, *R*; *Np*, *Cl*
1469. Savukoski (KemL) 11. VII, *EMT*; —
1470. Utsjoki (InL) 12. VII, *EMT*; *Nb*, *Hp*, *Nh*
1471. Ranua (PP) 11. VII, *EMT*; *Cl*
1472. Ranua (PP) 10. VII, *EMT*; —
1473. Ranua (PP) 11. VII, *EMT*; —
1474. Ranua (PP) 9. VII, *EMT*; *Ns*
1475. Kuusamo (Ks) 14. VII, *HSR*; *Np*
1476. Kuusamo (Ks) 14. VII, *HSR*; *Np*, *Cl*
1477. Kuusamo (Ks) 15. VII, *VSR*; *Np*
1478. Ranua (PP) 14. VII, *RR*; *Np*, *Cl*
1479. Ranua (PP) 15. VII, *EMT*; *Ns*
1480. Ranua (PP) 13. VII, *EMT*; *Ppc*
1481. Savukoski (KemL) 16. VII, *IR*; *Np*, *Cl*
1482. Savukoski (KemL) 13. VII, *EMT*; *Cl*
1483. Savukoski (KemL) 10. VII, *EMT*; *Hp*, *Cl*
1484. Savukoski (KemL) 14. VII, *EMT*; *Hp*
1485. Ranua (PP) 15. VII, *EMT*; —
1486. Ranua (PP) 14. VII, *EMT*; —
1487. Ranua (PP) 17. VII, *KR*; *Np*, *Hp*
1488. Ranua (PP) 17. VII, *EMT*; *Hp*
1489. Savukoski (KemL) 14. VII, *RR*; —
1490. Salla (Ks) 7. VII, *EMT*; —
1491. Kittilä (KemL) 19. VII, *RTR*; *Hp*
1492. Sodankylä (KemL) 4. VII, *KgR*; *Np*
1493. Kittilä (KemL) 15. VII, *EMT*; —
1494. Salla (Ks) 9. VII, *EMT*; —
1495. Salla (Ks) 12. VII, *EMT*; *Hp*
1496. Ranua (PP) 16. VII, *KgR*; —
1497. Ranua (PP) 16. VII, *KgR*; *Np*
1498. Ranua (PP) 16. VII, *EMT*; *Csc*
1499. Ranua (PP) 17. VII, *EMT*; —
1500. Inari (InL) 15. VII, *EMT*; *Csc*
1501. Inari (InL) 16. VII, *EMT*; *Hp*, *Cl*
1502. Inari (InL) 15. VII, *EMT*; *Hp*, *Nk*
1503. Inari (InL) 17. VII, *EMT*; —
1504. Inari (InL) 17. VII, *EMT*; *Hp*
1505. Kittilä (KemL) 14. VII, *KgR*; *Cl*
1506. Inari (InL) 12. VII, *KgR*; —
1507. Salla (Ks) 15. VII, *EMT*; *Hp*
1508. Salla (Ks) 15. VII, *EMT*; *Hp*, *Ppc*
1509. Savukoski (KemL) 17. VII, *EMT*; *Hp*
1510. Savukoski (KemL) 17. VII, *RR*; *Np*, *Hp*, *Cl*
1511. Sodankylä (KemL) 18. VII, *EMT*; *Nb*
1512. Sodankylä (KemL) 18. VII, *EMT*; *Hp*
1513. Sodankylä (KemL) 18. VII, *LR*; *Np*
1514. Sodankylä (KemL) 18. VII, *LR*; *Np*
1515. Sodankylä (KemL) 18. VII, *EMT*; *Cl*
1516. Sodankylä (KemL) 18. VII, *KgR*; —
1517. Posio (Ks) 19. VII, *KR*; *Hp*
1518. Posio (Ks) 19. VII, *EMT*; —
1519. Posio (Ks) 19. VII, *EMT*; *Hp*
1520. Ranua (PP) 19. VII, *EMT*; —
1521. Ranua (PP) 20. VII, *RR*; *Np*
1522. Posio (Ks) 20. VII, *EMT*; *Hp*, *Cl*
1523. Ranua (PP) 20. VII, *EMT*; *Ns*, *Hp*, *Cl*
1524. Sodankylä (KemL) 21. VII, *RTR*; *Np*, *Hp*, *Cl*
1525. Sodankylä (KemL) 23. VII, *EMT*; *Hp*
1526. Inari (InL) 22. VII, *EMT*; *Hp*
1527. Inari (InL) 19. VII, *RR*; *Np*
1528. Inari (InL) 23. VII, *EMT*; —
1529. Inari (InL) 19. VII, *EMT*; —
1530. Inari (InL) 18. VII, *RTR*; *Np*, *Hp*
1531. Inari (InL) 23. VII, *EMT*; *Nb*, *Ppc*
1532. Inari (InL) 22. VII, *EMT*; —
1533. Inari (InL) 18. VII, *EMT*; *Nh*
1534. Inari (InL) 20. VII, *EMT*; *Hp*
1535. Inari (InL) 19. VII, *EMT*; —
1536. Inari (InL) 23. VII, *EMT*; —
1537. Inari (InL) 21. VII, *EMT*; —

1538. Inari (InL) 23. VII, *EMT*; *Hp*
1539. Inari (InL) 22. VII, *EMT*; —
1540. Inari (InL) 23. VII, *EMT*; —
1541. Kittilä (KemL) 13. VII, *EMT*; *Np*
1542. Enontekiö (EnL) 23. VII, *EMT*; *Hp*
1543. Muonio (KemL) 24. VII, *EMT*; *Hp*
1544. Muonio (KemL) 21. VII, *EMT*; *Hp*, *Cl*
1545. Muonio (KemL) 22. VII, *HSR*; *Np*, *Hp*, *Cl*
1546. Savukoski (KemL) 22. VII, *KR*; *Np*
1547. Inari (InL) 20. VII, *EMT*; —
1548. Ranua (PP) 24. VII, *EMT*; *Hp*
1549. Ranua (PP) 23. VII, *KR*; *Np*, *Hp*, *Cl*
1550. Ranua (PP) 24. VII, *EMT*; —
1551. Savukoski (KemL) 17. VII, *EMT*; —
1552. Sodankylä (KemL) 26. VII, *KgR*; *Np*
1553. Sodankylä (KemL) 24. VII, *VSR*; *Np*
1554. Salla (Ks) 25. VII, *EMT*; *Hp*
1555. Kuusamo (Ks) 23. VII, *KgR*; *Np*, *Csc*, *Hp*
1556. Kuusamo (Ks) 18. VII, *VSR*; —
1557. Kuusamo (Ks) 19. VII, *HSR*; *Np*
1558. Kuusamo (Ks) 22. VII, *HSR*; *Hp*
1559. Salla (Ks) 26. VII, *EMT*; *Cl*, *Nh*
1560. Posio (Ks) 27. VII, *EMT*; —
1561. Posio (Ks) 27. VII, *EMT*; —
1562. Posio (Ks) 25. VII, *EMT*; *Nh*
1563. Posio (Ks) 25. VII, *EMT*; *Hp*
1564. Posio (Ks) 25. VII, *EMT*; —
1565. Inari (InL) 24. VII, *EMT*; *Hp*
1566. Inari (InL) 24. VII, *EMT*; *Nh*
1567. Inari (InL) 25. VII, *EMT*; *Hp*
1568. Inari (InL) 27. VII, *EMT*; —
1569. Inari (InL) 26. VII, *EMT*; *Hp*, *Nh*
1570. Sodankylä (KemL) 26. VII, *EMT*; —
1571. Sodankylä (KemL) 26. VII, *EMT*; *Hp*, *Cl*, *Ppc*
1572. Inari (InL) 22. VII, *EMT*; —
1573. Inari (InL) 27. VII, *EMT*; *Csc*
1574. Kuusjärvi (PK) 1. VIII, *IR*; —
1575. Kuusjärvi (PK) 2. VIII, *RTR*; *Np*, *Hp*
1576. Kuusjärvi (PK) 1. VIII, *IR*; *Np*
1577. Polvijärvi (PK) 3. VIII, *R*; *Np*
1578. Salla (Ks) 28. VII, *LR*; *Np*
1579. Inari (InL) 2. VIII, *EMT*; *Hp*
1580. Inari (InL) 2. VIII, *EMT*; —
1581. Inari (InL) 2. VIII, *EMT*; *Nb*, *Hp*, *Nh*
1582. Kuusamo (Ks) 5. VIII, *KgR*; *Hp*
1583. Kuusamo (Ks) 3. VIII, *HSR*; *Np*
1584. Kuusamo (Ks) 3. VIII, *LR*; *Np*
1585. Salla (Ks) 5. VIII, *VT*; *Nh*
1586. Savukoski (KemL) 7. VIII, *KR*; *Np*, *Hp*, *Nh*
1587. Salla (Ks) 8. VIII, *EMT*; *Hp*
1588. Posio (Ks) 8. VIII, *EMT*; *Hp*
1589. Posio (Ks) 7. VIII, *EMT*; *Np*, *Hp*
1590. Posio (Ks) 7. VIII, *EMT*; —
1591. Inari (InL) 5. VIII, *EMT*; —
1592. Inari (InL) 5. VIII, *EMT*; *Hp*
1593. Inari (InL) 9. VIII, *EMT*; *Nb*, *Nh*
1594. Polvijärvi (PK) 6. VIII, *VT*; *Ns*
1595. Polvijärvi (PK) 7. VIII, *VT*; —
1596. Pielisjärvi (PK) 12. VIII, *VT*; *Hp*
1597. Polvijärvi (PK) 6. VIII, *VSR*; *Np*
1598. Juuka (PK) 10. VIII, *TR*; *Np*
1599. Salla (Ks) 12. VIII, *EMT*; *Hp*
1600. Salla (Ks) 12. VIII, *EMT*; *Cl*
1601. Salla (Ks) 12. VIII, *EMT*; *Np*, *Hp*
1602. Pelkosenniemi (KemL) 12. VIII, *HSR*; *Np*, *Hp*
1603. Pelkosenniemi (KemL) 11. VIII, *EMT*; *Hp*
1604. Pielisjärvi (PK) 12. VIII, *VT*; *Ns*
1605. Posio (Ks) 10. VIII, *IR*; *Np*
1606. Posio (Ks) 12. VIII, *EMT*; —
1607. Posio (Ks) 11. VIII, *RR*; *Np*, *Hp*
1608. Pielisjärvi (PK) 14. VIII, *VT*; *Ns*, *Hp*
1609. Pielisjärvi (PK) 15. VIII, *IR*; *Np*
1610. Pielisjärvi (PK) 15. VIII, *KR*; *Np*
1611. Posio (Ks) 14. VIII, *KgR*; *Np*
1612. Posio (Ks) 13. VIII, *IR*; —
1613. Posio (Ks) 13. VIII, *RTR*; *Np*
1614. Posio (Ks) 11. VIII, *TR*; *Np*
1615. Posio (Ks) 15. VIII, *HSR*; —
1616. Posio (Ks) 18. VIII, *HSR*; *Np*
1617. Posio (Ks) 16. VIII, *KgR*; —
1618. Posio (Ks) 15. VIII, *HSR*; *Nb*
1619. Pietarsaari (KP) 18. VIII, *VT*; *Ns*, *Csc*, *Hp*
1620. Kuusamo (Ks) 22. VIII, *EMT*; *Hp*
1621. Kuusamo (Ks) 21. VIII, *EMT*; —
1622. Posio (Ks) 15. VIII, *EMT*; —
1623. Posio (Ks) 17. VIII, *EMT*; —
1624. Parkano (St) 23. VIII, *VT*; —
1625. Korppoo (V) 21. VIII, *IR*; *Np*
1626. Kuusamo (Ks) 18. VIII, *EMT*; —
1627. Kuusamo (Ks) 18. VIII, *EMT*; —
1628. Kuusamo (Ks) 22. VIII, *EMT*; —
1629. Kuusamo (Ks) 22. VIII, *EMT*; *Hp*
1630. Kuusamo (Ks) 20. VIII, *EMT*; *Hp*
1631. Saarijärvi (PH) 17. VIII, *IR*; *Np*
1632. Saarijärvi (PH) 15. VIII, *VT*; *Ns*, *Hp*
1633. Viitasaari (PH) 13. VIII, *VT*; *Ns*
1634. Viitasaari (PH) 10. VIII, *VT*; *Ns*
1635. Kuusamo (Ks) 23. VIII, *EMT*; *Cl*
1636. Kuusamo (Ks) 23. VIII, *EMT*; —
1637. Sonkajärvi (PS) 26. VIII, *EMT*; *Nb*
1638. Sonkajärvi (PS) 25. VIII, *LR*; *Np*
1639. Sonkajärvi (PS) 26. VIII, *KR*; *Np*
1640. Sonkajärvi (PS) 25. VIII, *VT*; —
1641. Sonkajärvi (PS) 25. VIII, *VSR*; *Hp*
1642. Kihniö (St) 26. VIII, *VT*; *Ns*
1643. Kihniö (St) 27. VIII, *VT*; —
1644. Parkano (St) 25. VIII, *IR*; *Nb*, *Ht*, *Nh*
1645. Inari (InL) 23. VIII, *EMT*; —
1646. Inari (InL) 19. VIII, *EMT*; *Np*, *Cl*, *Ppu*
1647. Inari (InL) 23. VIII, *EMT*; *Nb*
1648. Virrat (PH) 30. VIII, *VT*; *Ns*
1649. Virrat (PH) 30. VIII, *VT*; *Ns*
1650. Virrat (PH) 1. IX, *VT*; *Ns*
1651. Heinola (EH) 4. IX, *VT*; —
1652. Mäntyharju (ES) 3. IX, *VT*; *Ns*

1653. Heinola (EH) 4. IX, *VT*; *Ns*
1654. Virrat (PH) 8. IX, *VT*; *Ns*
1655. Virrat (PH) 8. IX, *VT*; *Ns*
1656. Virrat (PH) 8. IX, *VT*; *Ns*
1657. Maksamaa (EP) 10. IX, *VT*; *Ns*, *Ppe*
1658. Maksamaa (EP) 7. IX, *VT*; *Ns*, *Hp*
1659. Uusikaarlepyy (KP) 15. IX, *VT*; *Ns*
1660. Uusikaarlepyy (KP) 15. IX, *IR*; *Nb*
1661. Uusikaarlepyy (KP) 14. IX, *VT*; —
1662. Uusikaarlepyy (KP) 16. IX, *KR*; —
1663. Pietarsaari (KP) 17. IX, *VT*; *Ns*
1664. Pietarsaari (KP) 17. IX, *VT*; *Nh*
1665. Pietarsaari (KP) 18. IX, *VT*; *Np*, *Hp*
1666. Pietarsaari (KP) 18. IX, *KR*; *Np*, *Nh*
1667. Kruunupyy (KP) 23. IX, *VT*; *Ns*
1668. Kruunupyy (KP) 23. IX, *VT*; —
1669. Ähtävä (KP) 22. IX, *VT*; —
1670. Ähtävä (KP) 22. IX, *VT*; *Ns*

4. DISTRIBUTION AND HABITATS OF THE FINNISH CAMISIID SPECIES

A. DISTRIBUTION IN FINLAND, AND NOTES ON THE GENERAL DISTRIBUTION

From the data obtained from the transect survey samples, it has been possible to prepare preliminary maps of the distribution of the Camisiid species most commonly occurring in Finland. Maps of all the Camisiid species encountered in this country are presented in this paper; of these species, *Camisia horrida* has only been recorded by NORDENSKIÖLD (1901). In many cases the maps cannot yet be regarded as giving a true picture of the distribution of the species. In the present author's opinion they will, however, provide a good basis for further research along the same lines. In the absence of data on the localities, I have not been able to use the Camisiid material collected by NORDBERG (1936).

Since distribution maps have been prepared for all the Camisiid species encountered in Finland, it will be necessary, in addition to the list of the transect survey samples (Table 1), to record the species which have been found in other samples and which will not be mentioned before the description of the Camisiid fauna of the various forest and bog types. In addition to those listed in Table 1, the following species have been encountered in this country:

Nothrus palustris C. L. Koch: Tvärminne (U), *Corylus* thicket; Tammisaari (U), oak wood; Helsinki, Pasila (U), an Oxalis-Majanthemum forest; Kausala, rural district Iitti (EH), Oxalis-Myrtillus forest.

N. biciliatus C. L. Koch: Tvärminne (U), *Corylus* thicket.

Camisia horrida (Herm.): Mäntsälä (U) (according to NORDENSKIÖLD 1901), no recent observations.

Heminothrus thori (Berl.): Tvärminne (U), water swamp; Helsinki (U), water swamp.

In preparing the distribution maps and in the discussion of the distribution of the species, these finds have also been taken into account.

Camisia horrida (Herm.). — So far a single find from Finland (NORDENSKIÖLD 1901) (Fig. 2). It would seem probable that the absence of this species from the present author's material is due to the fact that it lives particularly among epiphytic mosses and lichens on trees (Grandjean 1936), and is known to occur commonly among mosses covering other solid surfaces as well (Strenzke 1952). It will probably prove to cover a wide range in Finland, judging from its general distribution: Swedish Lapland and Siberia (Trägårdh 1902, 1910 b), Spitzbergen and Norway (Thor 1937), Greenland (Hammer 1944), Germany (Willman 1931, Strenzke 1952), Austria (Franz 1950 a), Hungary (Balogh 1939, 1943), and Italy (Berlese 1896). There are records from N. Africa too (Nordenskiöld op.c.).

C. scabra L. (*C. segnis* (Hermann)). — According to the transect survey samples, *C. scabra* has a continuous range throughout S. and Central Finland, with an obviously decreasing frequency towards the north (Fig. 2). In this respect the picture of its distribution so obtained agrees well with the information available from other areas. Being known from Sweden (Forsslund 1945), Norway (Thor 1937), Denmark (Thamdrup 1932), Germany (Willman 1931, e.g.), the Netherlands (van den Hammen 1952), England (according to Trägårdh 1910 b), Switzerland (according to Thamdrup op.c.), Austria (Franz 1950 a), Hungary (Balogh 1939, 1943) and Italy (Berlese 1896), it seems to reach the northern limit of its range within Scandinavia. According to Thor (op.c.) it has not been found in Spitzbergen, neither is it known from Iceland (Tuxen 1943) or Greenland (Hammer 1944). The scarcity of *C. scabra* among the line-survey material from N. Finland may, however, also be due to the scarcity of those dry forests where this species reaches the peak of its abundance.

C. spinifer (C. L. Koch). — Only recently reported from Finland for the first time (Karppinen 1950). It shows the same features of distribution within this area as *C. scabra*, the northernmost finds from Finland so far known being from about lat. 65° N. (Fig. 3). The general range of *C. spinifer* includes at least Norway, S. Sweden, Denmark, the Netherlands, England, France, Austria, Hungary, Italy, and N. Africa. Thor (1937) reported a single specimen from Spitzbergen; hence the occurrence of this species in the north of Fennoscandia requires further study in the future.

C. segnis (Herm.) (*bicarinata* (C. L. Koch)). — Common over a wide area of Central and Southern Europe, recorded at least from Denmark, the Netherlands, Germany, France, Austria, Hungary, and Italy, but seems to become scarce towards the north. There are records from Iceland (Tuxen 1943), S. Norway (Thor 1937) and S. Sweden (Dalenius 1950), but the details of its northern range are still very insufficiently known. From Finland 3 localities only are known so far (Fig. 4), two of them being represented by one individual only. In a single locality, a peat-bog near Helsinki, the present author observed this species regularly, although never in abundance. For the present it would seem probable that *C. segnis* does not occur in abundance anywhere in Finland, but, on the other hand, it may have escaped attention because of its very specialized environmental requirements (cf. *Neonothrus humicola*).

C. lapponica Träg. — Some writers (e.g. Forsslund and Franz) consider this a boreoalpine species. It is now known from Greenland (Hammer 1944), from subalpine localities of Norway (Thor 1937), from N. Sweden (Trägårdh 1910 b, Forsslund 1945) and from a number of localities in Finland (Fig. 5), with its highest frequency in the north. So far it has not been recorded from Spitzbergen or Iceland. Its southern range includes the Alps and the Riesengebirge mountains, but there are also finds from East Prussia just between the northern and southern areas of its distribution. Within its Finnish area *C. lapponica* does not display any of the features of a mountain species; on the contrary, it occurs abundantly in suitable localities in the southernmost part of this area as well (Karppinen 1952), including the Alandian archipelago and the N. coast of the Gulf of Finland.

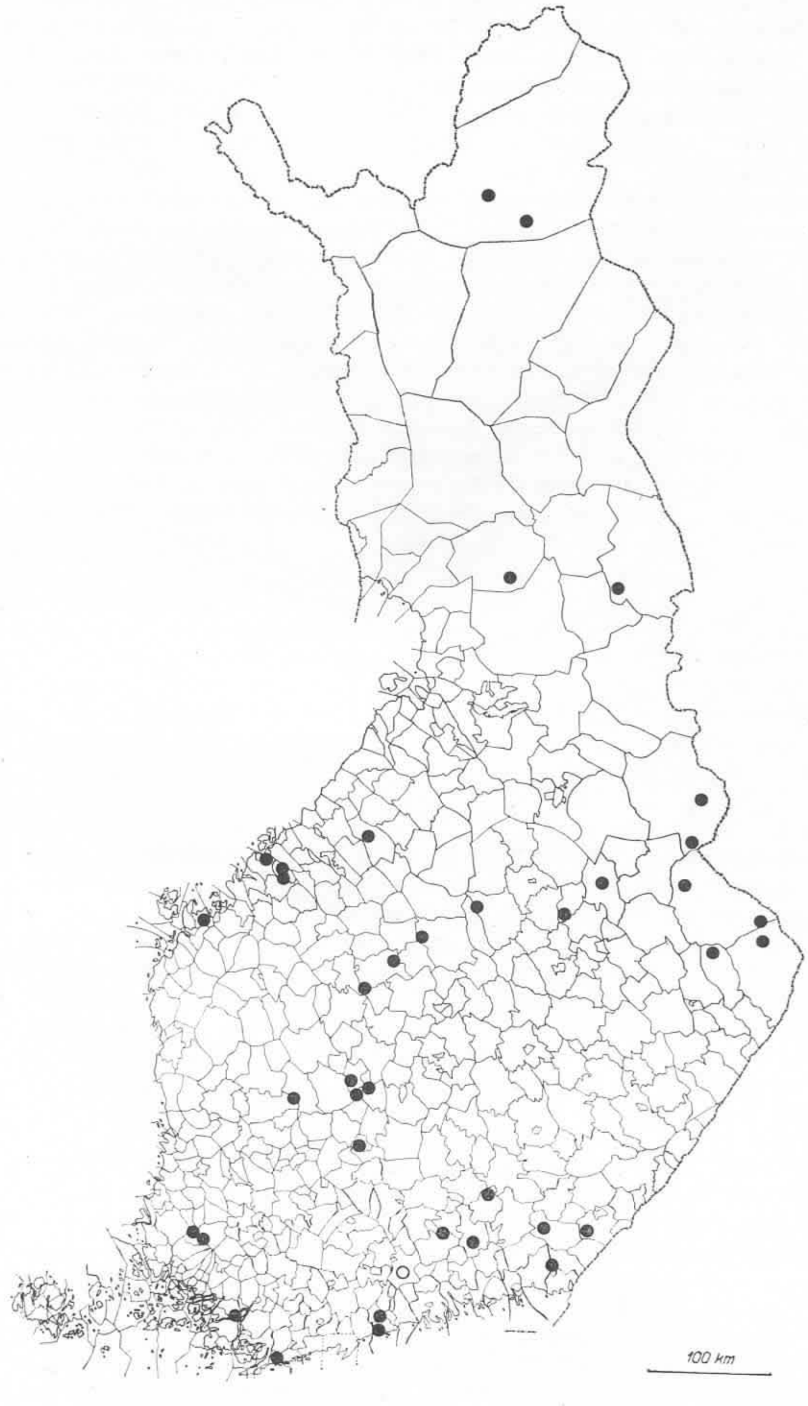

Fig. 2. *Camisia scabra* (●) and *C. horrida* (○).

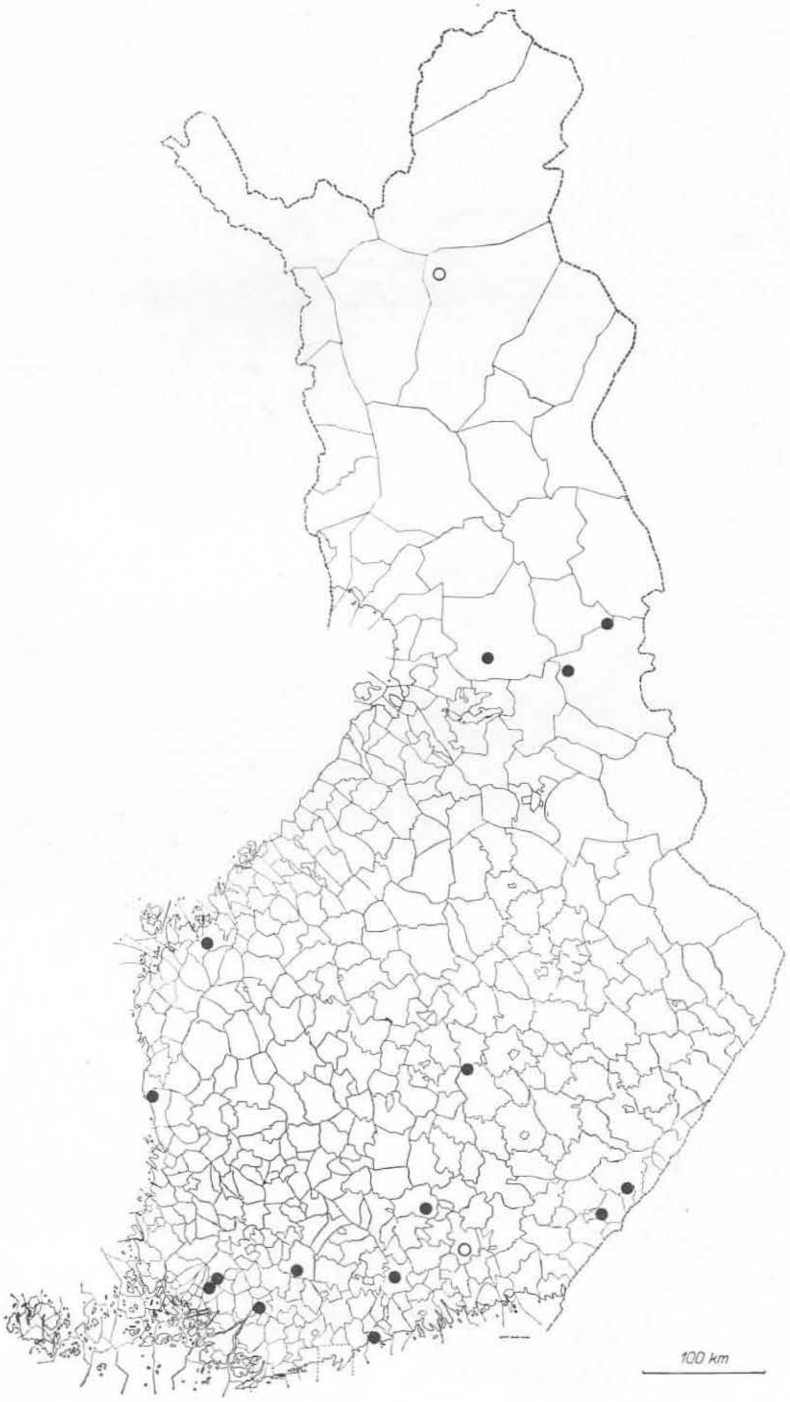

Fig. 3. *Camisia spinifer* (●) and *Heminothrus targionii* (○).

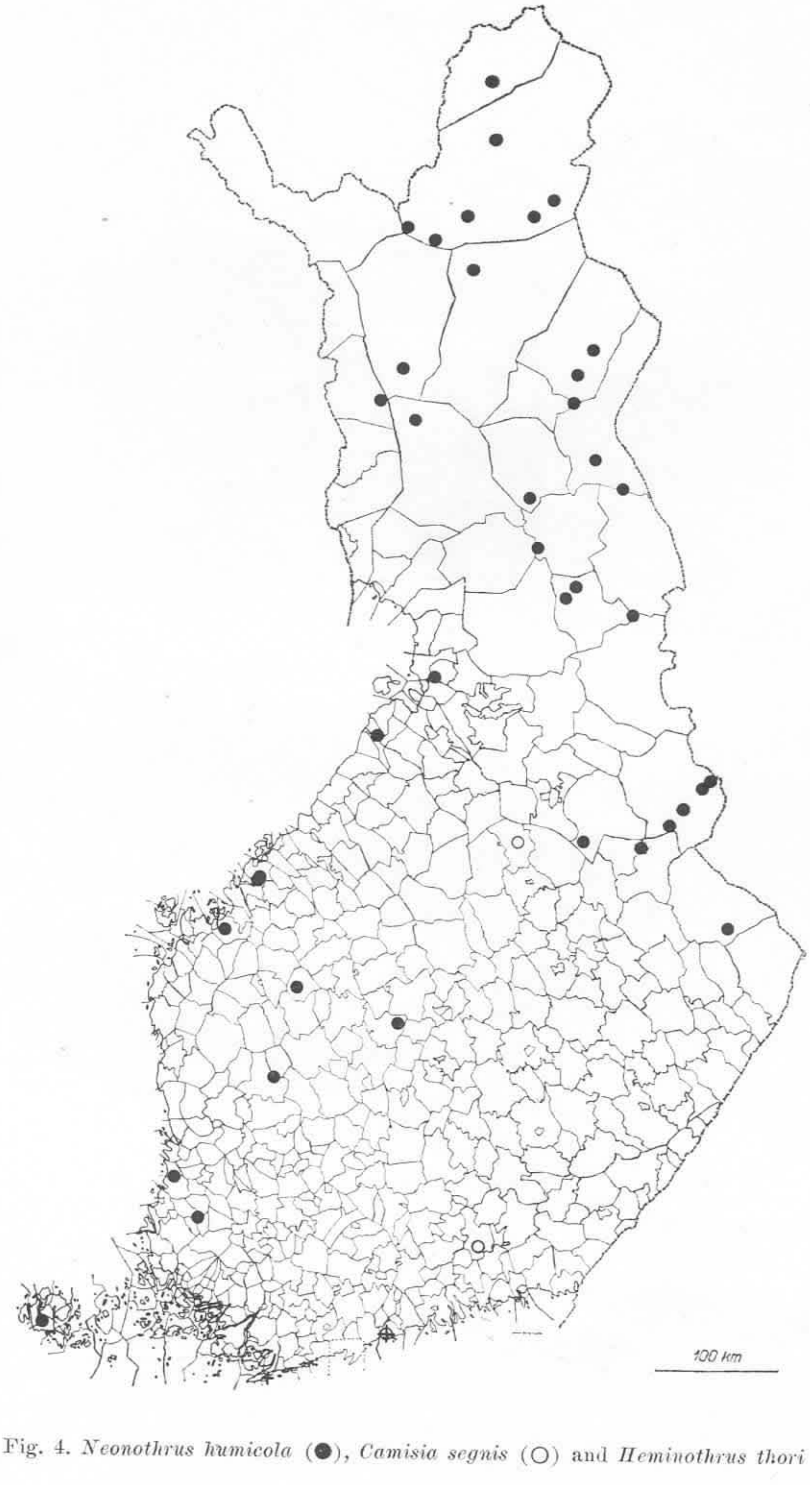

Fig. 4. *Neonothrus humicola* (●), *Camisia segnis* (○) and *Heminothrus thori* (+).

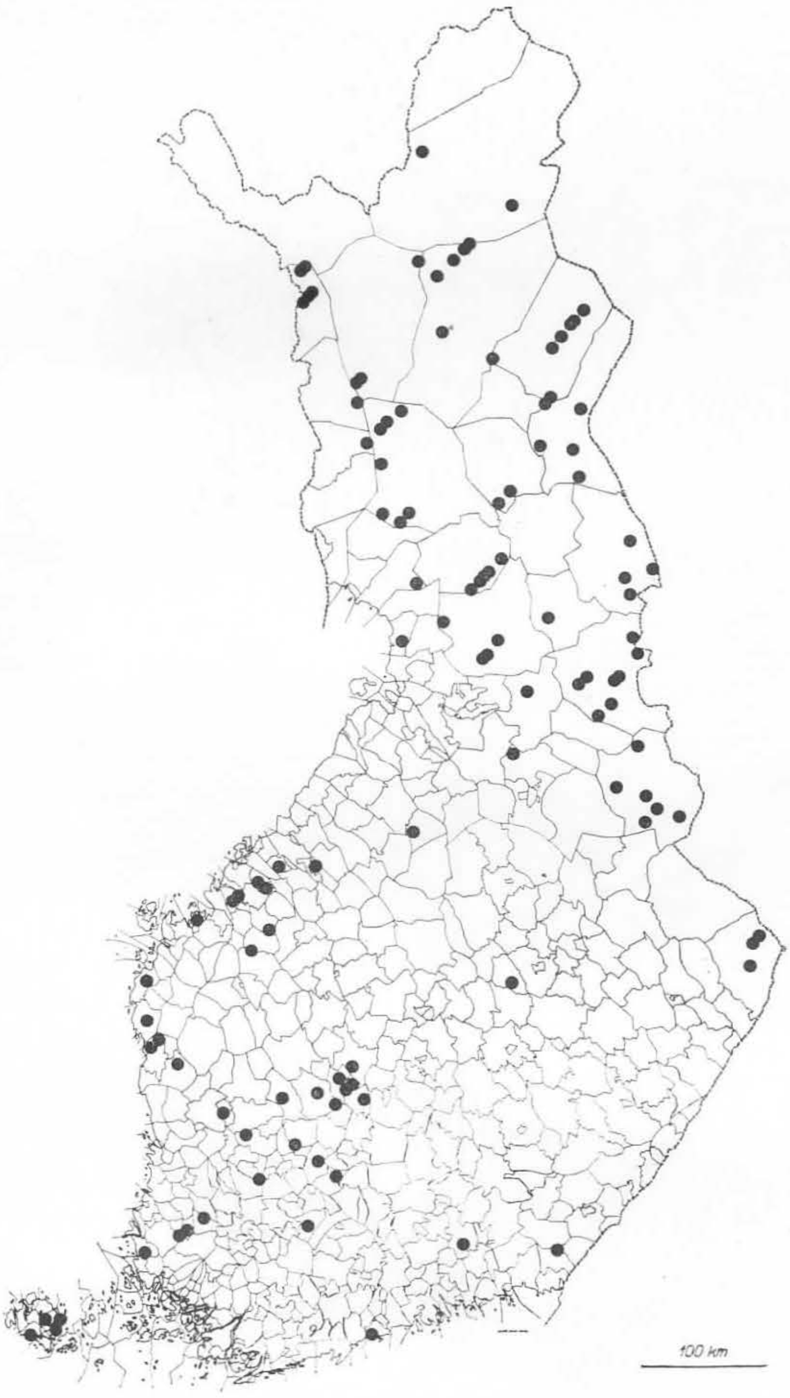

Fig. 5. *Camisia lapponica.*

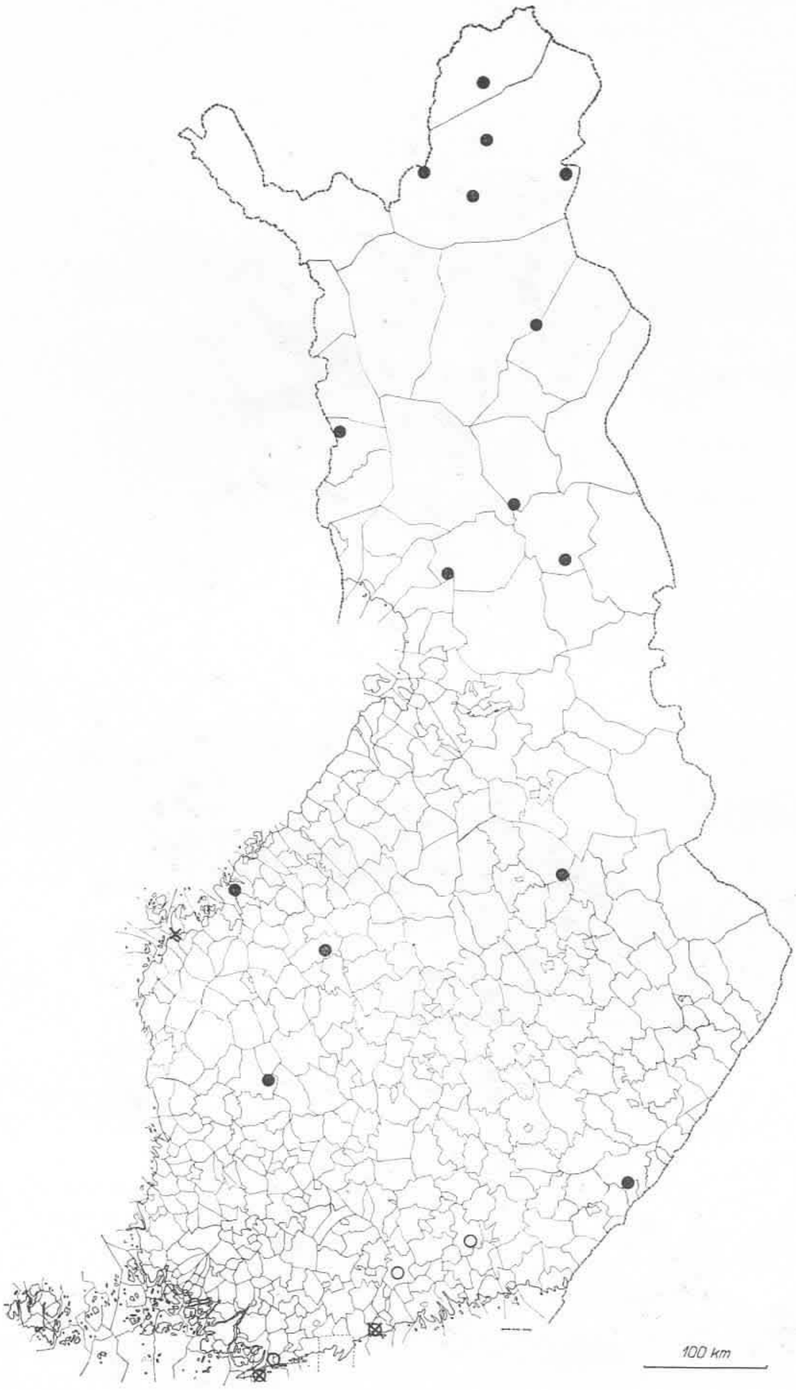

Fig. 6. *Nothrus borussicus* (●), *N. palustris* (○) and *N. biciliatus* (×).

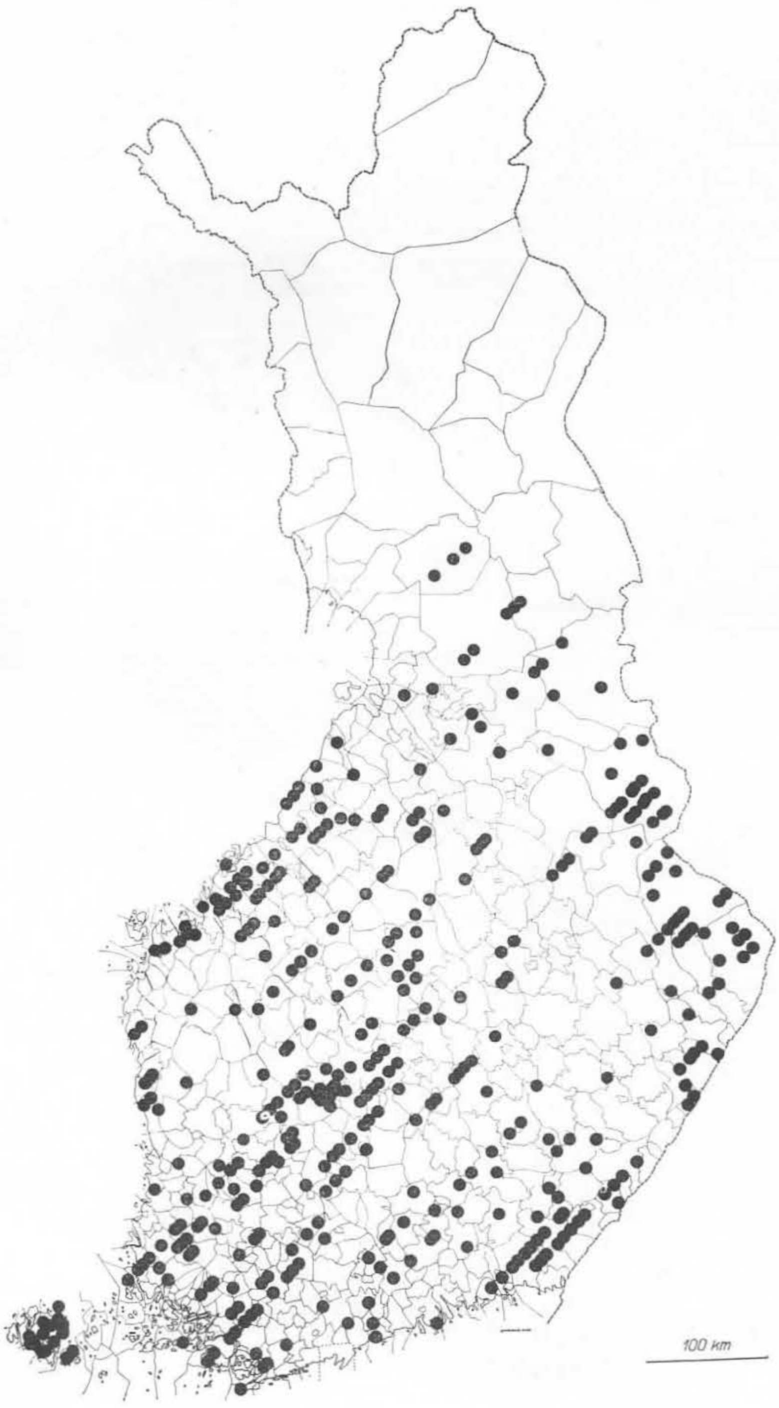

Fig. 7. *Nothrus silvestris.*

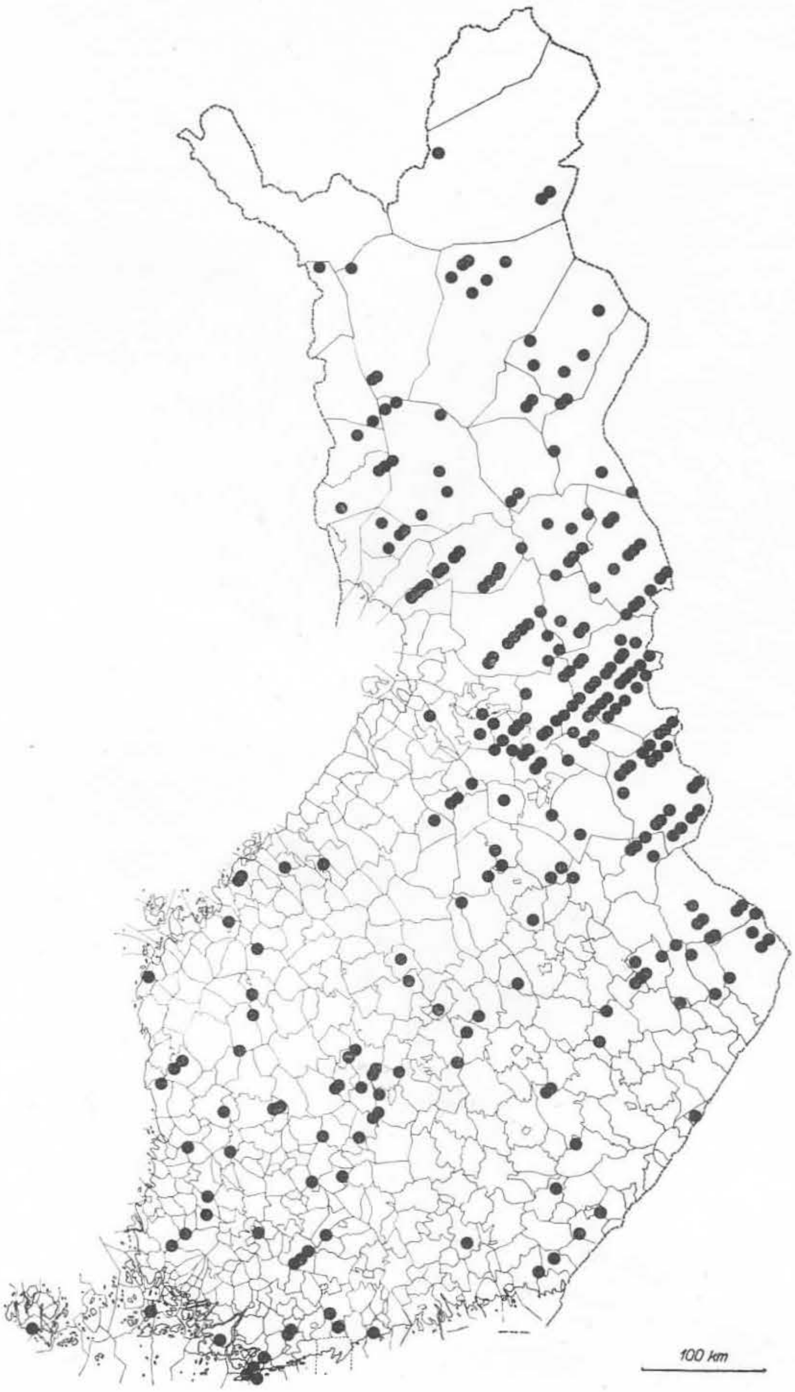

Fig. 8. *Nothrus pratensis.*

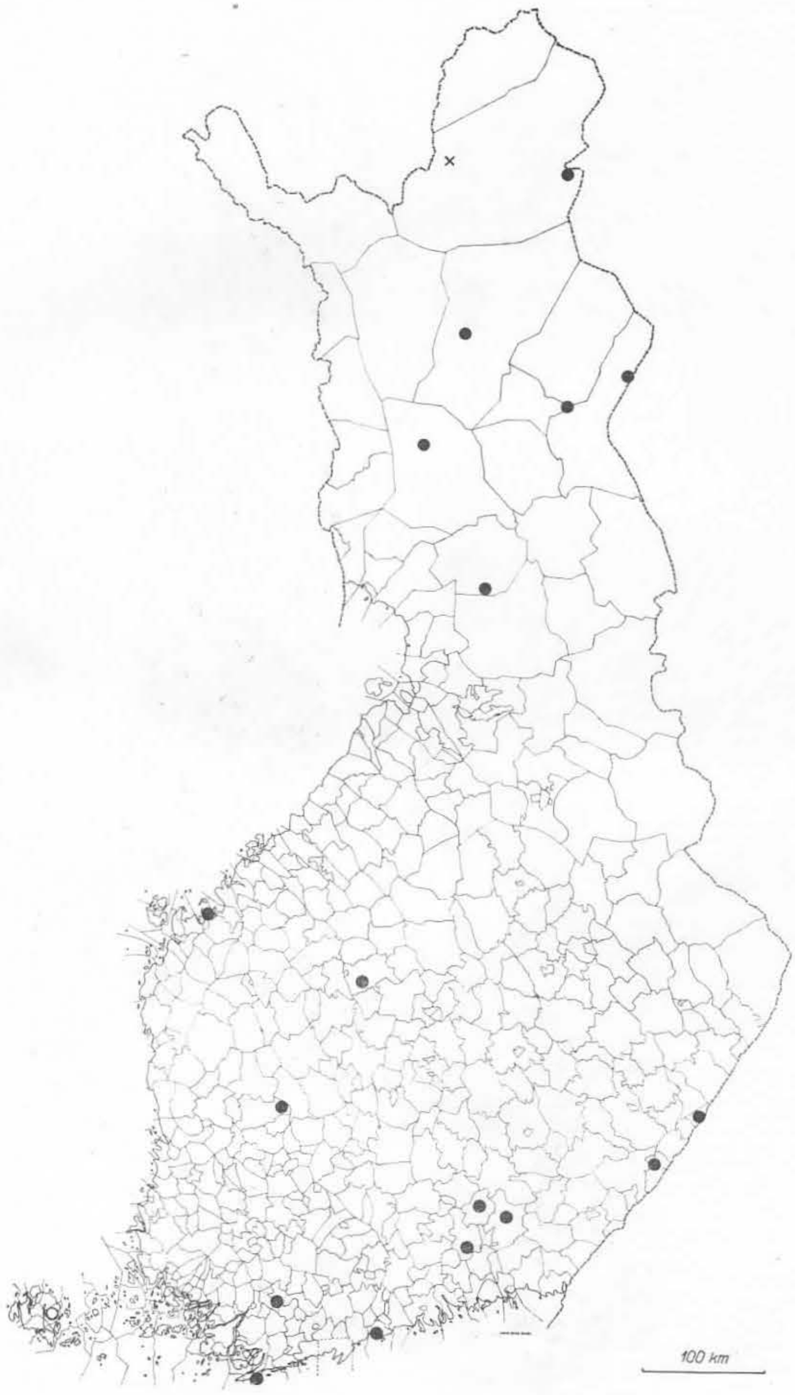

Fig. 9. *Platynothrus peltifer* (●), *P. capillatus* var. *septentrionalis* (○) and *P. punctatus* (+).

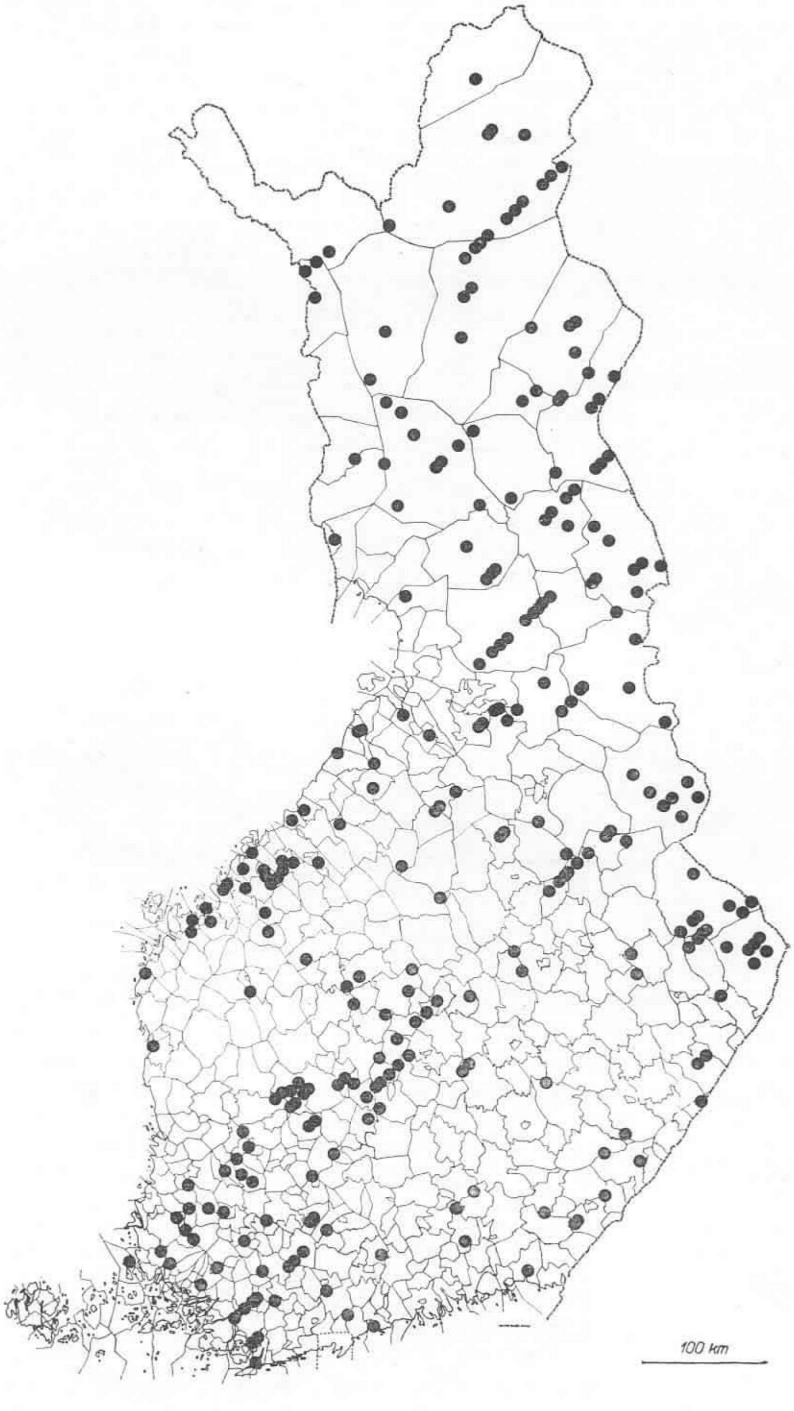

Fig. 10. *Heminothrus paolianus* var. *longisetosus*.

Nothrus palustris C. L. Koch. — This species occurs chiefly in deciduous woods in Finland. As the line-survey samples do not include rich forests, information concerning the distribution of this species is but meagre so far. The present author found this species in all the deciduous forest localities investigated so far (abundant in U. Tvärminne), hence more detailed studies are necessary to discover the distribution of *N. palustris* in Finland (Fig. 6). In other areas this species lives exclusively in deciduous woods, too. In S. Sweden it is common in deciduous forests with beech, oak and hazel (DALENIUS 1950), and both BORNEBUSCH (1930) and THAMDRUP (1932) mention it from similar localities in Denmark. According to FORSSLUND (1945) it occurs in woods belonging to the Geranium type in N. Sweden, but is not abundant there. The scanty information available from Finland is thus in full agreement with the observations made in other areas.

N. biciliatus (C. L. Koch). — This species known from S. and Central Europe in the south to the arctic districts of N. Europe (cf. TRÄGÅRDH 1910 b, STRENZKE 1952) has so far only been found in a few Finnish localities. NORDENSKIÖLD (1901) reported it from the Helsinki area (U) and from Vaasa (EP), and the present author found it in a *Corylus* thicket at the Zool.Station, Tvärminne (U) (Fig. 6).

N. silvestris Nic. — The localities so far known for this species from Finland cover almost the same area as those for *Camisia scabra*, i.e., it is known chiefly from S. and Central Finland, to about lat. 65° N. (Fig. 7). The absence or scarcity of *N. silvestris* from areas beyond lat 66° N. fits well within the features of its general distribution. There are records of *N. silvestris* from Iceland and Greenland, but according to more recent information these finds refer to *N. borussicus* Selln. (HAMMER 1944). Hence it would seem probable that this species is in fact absent from the northernmost parts of Fennoscandia. From S. Finland and Scandinavia its area extends throughout Europe at least to N. Africa. In Finland *N. silvestris* is the predominant Camisiid species of many different kinds of forest localities.

N. borussicus Selln. — So far known from Greenland, Iceland, N. Norway, Sweden and Finland in the north, and from Germany (WILLMANN 1935) and the Alps (FRANZ 1950 a). Perhaps a boreoalpine species. So far 15 localities only are known from Finland; its distribution is thus incompletely known (Fig. 6), but it is noteworthy that there are so far no finds from the southernmost parts of this area.

N. pratensis Selln. — A characteristic species of bogs (cf. PEUS 1932). It is very common in Finland, but according to the line-survey samples the peak of its frequency occurs in the north, where large bogs cover much wider areas than further south (Fig. 8). The data at present available indicate that this species has a continuous range all over Finland and is present wherever there are suitable localities. The first finds from Finland are from 1903, but they were not published until recently (KARPPINEN 1952). Finds of this species are furthermore known at least from Norway, Germany, Austria and Belgium.

Platynothrus peltifer (C. L. Koch). — The range of this species seems to include almost the whole of Europe (FORSSLUND 1945) and Greenland (HAMMER 1944). As regards Finland, the transect survey samples do not give any conclusive picture of its distribution (Fig. 9), since *P. peltifer* lives preferably on periodically flooded swampy shores or in fens, i.e., in localities which were not covered by the transect survey. Although only 11 localities are so far known for this species in Finland, it will probably prove to have a wide range when its specific habitats have been more carefully surveyed.

P. capillatus Berl. var. *septentrionalis* Selln. — Only recently recorded from Finland (KARPPINEN 1953); so far a single find from A: Sund (8 ad. and 2 tritonymphs from a *VT* forest) is known from this country (Fig. 9). This northern form of *P. capillatus*

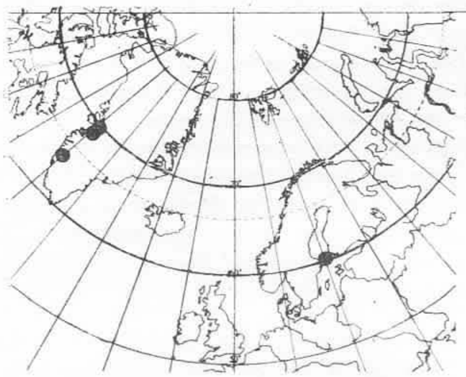

Fig. 11.

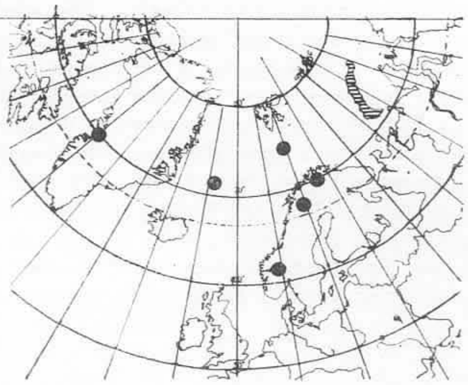

Fig. 12.

Fig. 11. The localities so far known for *Platynothrus capillatus* var. *septentrionalis*.

Fig. 12. The localities so far known for ***Platynothrus punctatus***. The exact position of the Novaja Zemlja find is not known.

was formerly known from the west coast of Greenland only (HAMMER 1944); the Finnish locality is the southernmost one known so far for this race. The nominate race has been reported from Hungary (BALOGH 1943) and the Austrian Alps (FRANZ 1950 a). Fig. 11 includes all localities of var. *septentrionalis* known to the present author.

P. punctatus (C. L. Koch). — A boreal species now known from Greenland (STRENZKE 1951), Novaja Zemlja, the Jan Mayen and Bear Islands (TRÄGÅRDH 1910 b), Norway (THOR 1937), N. Sweden (TRÄGÅRDH op.c.) and N. Finland (Fig. 9). All localities of this species so far known to the present author are included in Fig. 12, showing that all finds except one are from localities well beyond the Arctic Circle.

Neonothrus humicola Forssl. — So far known only from N. Sweden (FORSSLUND 1945), and from a fairly wide area of Finland, with highest frequency obviously in the northern parts of the latter area (Fig. 4).

Heminothrus paolianus Berl. var. *longisetosus* Willm. — Known (according to STRENZKE 1952) from Italy (nominate race), Austria, Germany, Finland, Sweden, Norway and Greenland. There are finds from almost all over Finland, but the frequency of this species, too, seems to be highest in the northern part of this area, including Lapland (Fig. 10). In the samples from N. Finland this species was clearly more abundant than in those from Central and Southern Finland (cf. KARPPINEN 1952).

H. thori Berl. — According to SELLNICK (1929) and WILLMAN (1931), this species occurs in Germany in the soil of moist meadows. From Finland there are so far finds from two wet seashore marshes only (Fig. 4). This species was the predominating Camisiid species present in both the localities that have so far been studied (Helsinki and Tvärminne). As far as the author is aware, it is known also from S. Sweden (DALENIUS 1950), S. Norway (THOR 1937), Iceland (TUXEN 1943), Greenland (HAMMER 1944), Austria (FRANZ 1950 a), Hungary (BALOGH 1943) and Switzerland (according to NORDENSKIÖLD 1901).

H. targionii (Berl.). — Known from S. E. Norway (THOR 1937), the Netherlands (VAN DER HAMMEN 1952), Germany (WILLMAN 1931), England (MICHAEL 1888), Austria, Hungary and Italy (FRANZ 1950 a, BALOGH 1943, BERLESE 1896). According to the present author's material, this species is rather rare in Finland, only three localities being known so far (Fig. 3). These finds cannot give any definite picture of its distribution within this area, but they indicate that it will be found all over the country, once its typical habitat has been discovered.

B. THE CAMISIID FAUNA OF THE BIOLOGICAL PROVINCES OF FINLAND

On the basis of the transect survey samples, I have prepared a synopsis of the Camisiid species encountered in the different biological provinces [1] of Finland (Table 2). Since the number of species known from each province depends on the number of samples obtained, the number of samples received from each province has been included in this table.

The highest number of species (10 species each) has been found in the provinces of St, U and EH. Next, with nine species, comes PP. The small number of species in EnL is obviously due to the small number of samples; the same explanation is quite possible in the case of LK and EK also. On the other hand, it is likely that the fauna of A is, in fact, rather poor in species in the localities in question, for in this province the number of samples is not particularly low. It should be considered that V and KemL have 7 species each, although the number of samples is less than in A. The number of species from U is relatively high, because I have taken a considerable number of samples from various forest and bog types in this area. To some extent this effect is also present in EH, though a great number of transect survey samples have come from this province, so that the influence of the other samples is less remarkable.

In addition to the Camisiid fauna of the different biological provinces, the main features of the distribution of each species can also be seen from Table 2. *Nothrus pratensis* and *Heminothrus paolianus* have the widest distribution, insofar as they are known from 18 of our 19 biological provinces. Next come: *Nothrus silvestris* (16 provinces), *Camisia lapponica* (also 16), and *C. scabra* (14). I am inclined to attribute the widest distribution to *Nothrus pratensis,* even though *Heminothrus paolianus* is reported for the same number of provinces, since I am convinced that, given a slightly greater number of samples, *N. pratensis* would have been found in the region of EnL as well, whilst it seems likely that *H. paolianus* is really absent in A in the localities investigated in this connection.

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[1] The abbreviations of the names of provinces refer to the map at the end of this paper.

Table 2. Occurrence of the different Camisiid species in the biological provinces of Finland. The figures in parentheses refer to finds not included in the transect survey samples. Abbreviations of the names of provinces: cf. the map at the end of this paper.

Of the 1 595 transect survey samples:	77	62	19	21	82	178	97	6	48	86	53	126	145	205	193	96	60	40	1	No. of provinces
Biological province	A	V	U	EK	St	EH	ES	LK	EP	PH	PS	PK	KP	Kn	PP	Ks	KemL	InL	EnL	
Nothrus pratensis	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×		18
N. silvestris	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×				16
N. palustris			(×)			(×)														2
N. borussicus					×	×	×				×		×		×		×	×		8
N. biciliatus			(×)																	1
Camisia scabra		×	(×)		×	×	×		×	×	×	×	×	×	×	×		×		14
C. segnis			(×)								×									2
C. spinifer		×	(×)		×	×	×		×					×	×	×				9
C. lapponica	×	×	(×)	×	×	×			×	×	×	×	×	×	×	×	×	×		16
Heminothrus paolianus		×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	18
H. targionii					×	(×)											×			3
H. thori			(×)																	1
Platynothrus peltifer		×			×	×	×	×	×	×					×	×	×	×		11
P. capillatus	×																			1
P. punctatus																		×		1
Neonothrus humicola	×				×				×	×		×	×	×	×	×	×	×		11
Camisia horrida			(×)																	1
Total spp.	5	7	11	4	10	10	7	4	8	7	7	6	7	7	9	8	7	8	1	

C. THE CAMISIID FAUNA OF THE DIFFERENT FOREST AND PEATLAND VEGETATION TYPES

A list is given in the following of all the forest and peatland types from which samples have been taken in connection with this work for the investigation of the Camisiid fauna.

- Forests
  - Dry heathy forests
    - Cladina type (*ClT*)
    - Calluna type (*CT*)
    - Empetrum-Myrtillus type (*EMT*)
    - Vaccinium type (*VT*)

  - Moist heathy forests
    - Hylocomium-Myrtillus type (*HMT*)
    - Myrtillus type (*MT*)
    - Oxalis-Myrtillus type (*OMT*)

  - Rich forests
    - Oxalis-Majanthemum type (*OMaT*)

- Peatlands
  - A. Peatlands in the natural state
    - a. *Korvet, K.* Spruce-hardwoods peatland forests
      - *Varsinainen korpi, VK.* Ordinary spruce-hardwoods peatland forest

    - b. *Rämeet, R.* Pine bogs
      - *Kangasräme, KgR.* Peaty pine forest
      - *Korpiräme, KR.* Peatland forest intermediate between the spruce-hardwoods and pine bog types
      - *Isovarpuinen räme, IR.* Pine bog with rich growth of various undershrubs
      - *Huonompi sararäme, HSR.* Poorer quality Carex pine bog
      - *Niittyvillaräme, NR. Eriophorum vaginatum* pine bog
      - *Rahkainen niittyvillaräme, RNR. Eriophorum vaginatum* pine bog with dominant *Sphagnum fuscum*
      - *Rahkaräme, RR. Sphagnum fuscum* pine bog
      - *Lettoräme, LR.* Pine bog of fen type

    - *Nevat, N.* Wet treeless Sphagnum bogs
      - *Vesineva, VeN.* Water swamp
      - *Tulvaneva, TN.* Alluvial marsh
      - *Lyhytkortinen neva, LkN.* Bog with low sedges

  - Drained bogs
    - *Turvekankaat,* Drained peatlands with vegetation of firm forest type
      - *Puolukkaturvekangas, VTk.* Drained peatland of the *VT*

In order to obtain a conception of the occurrence of the species, the constancy has been calculated for each one of them. This figure lends itself to comparisons even between different types, provided the number of samples is 100 or more. If the number of samples is considerably less than 100, the constancy figures are no longer fully comparable between the different vegetation types, but they are still able to indicate which species occur in highes numbers. The number of samples is less than 100 in the pine bog types. The constancy figures were rounded off to integers. Whenever a value less than 0.5 was obtained, it has been replaced by the legend "accidental". Constancy figures between 0.5 — 0.9 have been rounded off to 1. It may be regarded as fairly certain that the constancy figures for *VT*, *EMT* and pine bog types are somewhat smaller than their true values, since some of the samples had dried so much during the long mail transport that the animals had died. I have tried to exclude at once all such samples, but quite obviously it is impossible to tell all the samples which should be rejected. There were a great number of samples in which other species belonging to the Oribatids and, for instance, collemboles were found, but no Camisiids. It is impossible to say with certainty in such cases whether the other species have endured the desiccation better than the Camisiids or whether the latter were originally absent. It is likely, however, that the Camisiids, being mites of considerable size and with a thick cuticle, are able to endure desiccation better than many other species. It would thus seem that in most of the cases where no Camisiids were found, they really were absent.

a. *Forests*

CAJANDER's (1926) classification of forest vegetation served as a basis for the present study. The present author agrees with PALMGREN (1930) and RENKONEN (1938), who emphasized the advantages of this classification as a basis for field studies on animal ecology.

In order to provide an adequate description of the various forest types, I shall quote the descriptions of CAJANDER (op. cit.) and merely add, where necessary, remarks on any points in which differences from his description occur in any given locality. It goes without saying that a general description cannot exactly fit all the forest habitats which have to be classified in a given type. This also goes for the peatland types (cf. p. 44).

By resorting to CAJANDER's descriptions I hope to give even a person unfamiliar with the Finnish forests a fairly correct idea of the locality concerned in each case.

Cladina type (ClT)

"The ground, as a rule, greyish white, owing to the abundance of *Cladina* vegetation (*Cladonia alpestris* in particular). The moss vegetation rather scanty. Herbs and grasses very few. Nor are the dwarf-shrubs very abundant, but are interspersed among the lichens. The forest consists for the most part of Scots pine forest. — Occurs most commonly and in its most typical form on the dry sandy heaths of Lapland and the far north, but is met with on the poorest and driest soils even of South Finland." (CAJANDER 1926.)

In the course of my excursions in Niinimäki, rural district Iitti, I found a heath region several hectares in area bearing almost exclusively *Cladina rangiferina* on rather extensive areas.

There were also scattered patches with *Calluna vulgaris* and *Vaccinium vitis-idaea*. The samples were taken from places where these dwarf shrubs did not grow.

100 samples were taken on 27. V. 1953; the constancy figures of the Camisiid species are included in Table 4.

Calluna type (CT)

"Moss vegetation (*Hylocomium parietinum*[1] and *H. proliferum*, *Ptilium crista-castrensis*, *Dicranum undulatum* and *D. scoparium*, etc.) and lichen vegetation (mainly *Cladonia rangiferina*) are present in varying degrees of abundance, the former vegetation alternating with the latter in respect of predominance. Herbaceous and grassy vegetation is somewhat more abundant and richer in species than in the (Cladina and Myrtillus-Cladina) types. Dwarf-shrub vegetation is abundant, *Calluna vulgaris* as a rule being the predominant species. Of the bushes *Juniperus communis* is fairly common. In most cases the forest-forming species is the Scots pine, but the birch (*Betula verrucosa* and *B. odorata*) and Norway spruce occur commonly as admixtures, and sometimes as the dominant tree species.

The *Calluna* type is distributed all over Finland ... In the southern half of the country, however, this type is more common than in North Finland." (CAJANDER 1926.)

The samples of the *CT* have been taken in Niinimäki, rural district of Iitti. The place where the samples were taken is fairly typically representative of its forest type. 100 samples were taken on 27. V. 1953. The constancy figures of the Camisiids are seen in Table 4.

Empetrum-Myrtillus type (EMT)

"Moss vegetation dominant, including mostly the so-called feather mosses (*Hylocomium*, *Dicranum*, etc.) and a certain proportion of *Polytrichum*; lichens are common, but less abundant than in the *MClT*. Herbaceous and grassy vegetation rather scanty. Dwarf-shrub vegetation, dominated by *Myrtillus* is, instead, very common and accompanied, although not usually in equal abundance, by *Empetrum nigrum*. In most cases the forest is formed by the Scots pine, almost constantly intermixed with the birch (*Betula verrucosa* and *B. odorata*), frequently with the Norway spruce and often with the aspen (*Populus tremula*). Sometimes the birch and especially the spruce are dominant. Widely distributed on the moderately dry heaths of Northern Finland." (CAJANDER 1926.)

The number of samples is 262 and all of them are transect survey samples (Table 4). Therefore, the constancy figures for the different Camisiid species are probably lower than the actual values, but they give a picture of the mutual order of abundance of the different species.

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[1] Now = *Pleurozium Schreberi*.

Vaccinium type (VT)

"Moss vegetation, including feather mosses mainly, is fairly continuous; lichens common, but, as a rule, of lesser importance. Herbs and grasses somewhat richer in species and more abundant than in the *Calluna* type. Dwarf-shrub vegetation rather plentiful, consisting mainly of *Vaccinium vitis idaea*, accompanied in varying degree by *Myrtillus nigra* and *Calluna vulgaris*. Juniper is very common. In most cases the forest is formed by the Scots pine, but the birch and the Norway spruce occur commonly in mixture, often also as the main forest-forming trees; the last named function is also sometimes usurped by the bushy *Alnus incana*.

Forests of the *Vaccinium* type occur on moderately dry sandy ground and on glacial ridges, sometimes even on moraine." (CAJANDER 1926.)

The samples of the *VT* also came from the transect survey; altogether 824 such samples have been taken. The same remark applies to their constancy figures as in the case of the preceding type. The constancy values for the different species are included in Table 4.

Hylocomium-Myrtillus type (HMT)

"This forest type is characterized by a continuous and exceedingly luxuriant feather moss vegetation. Lichens are scanty. Herbs and grasses are scanty, whilst dwarf-shrub vegetation is more or less abundant, including especially *Myrtillus nigra* and, apart from that, *Vaccinium vitis idaea* and *Empetrum nigrum*. In most cases the forest consists of rather open Norway spruce forest, with an admixture of birch. Often the Scots pine is also met with, mostly in the form of standard trees. This forest type takes up 9.9 per cent of the economically productive forest land of the Province of Oulu, and it occurs especially on the upper slopes of the mountains of the eastern parts of North Finland, where it is markedly dominant. It is less prevalent on the mountains of Western Lapland, occurring, as a rule, on their moist, northern slopes." (CAJANDER 1926.)

The samples from this type were collected on 2. VIII. 1953 by Mr. G. SIRÉN from Siulionpalo, rural district Pelkosenniemi, KemL. The total number of samples is 100, 50 of them from a birch stand and 50 from a spruce stand. According to these samples, there seems to be a striking difference between the constancy values of the Camisiid species occurring in the two habitats of this forest vegetation type, as is seen from the Table below.

	Birch stand	Spruce stand
Platynothrus peltifer	6	76
Neonothrus humicola	42	16
Heminothrus paolianus	6	24
Camisia lapponica	4	—
Nothrus pratensis	—	2

The constancy figures calculated for the *HMT* in general (birch and spruce stands together) are included in Table 4.

According to Cajander (1926), in the *HMT* forest the birch-dominated stage changes successively into a spruce-dominated stage. This was also emphasized by Sirén (1952) for his particular area of investigation, where he also collected the soil samples for the present study. On comparison of the fauna in the *HMT* birch stand and the *HMT* spruce stand it can be observed that the ratios of the Camisiid species are remarkably different in these successive stages.

The differences are so remarkable that the edaphic factors must differ considerably in these two subtypes. Sirén (op.cit.) indeed mentions that the possibly most notable characteristic of *HMT*, besides the scanty range of plant species, is its extraordinarily thick raw humus. The slowly decomposing humus, formed mainly of the dead parts of mosses and of roots of dwarf shrubs, would actually deserve the name of peat. Its formation is one of the most important consequences of the spruce-domination of the *HMT* forests. Such peat is not formed in *HMT* forests growing other tree species. Thus even in this respect a distinct difference exists between the birch and spruce stands. In addition the effect of defoliation upon the humus will produce different environmental conditions in the successive stages mentioned, where the vegetation is also very different. Some of the species occurring as ground vegetation (according to Sirén) are given in Table 3.

Table 3. The frequency and degree of dominance of plant species in the *HMT* forest of Siulionpalo, rural district Pelkosenniemi, KemL.

	Frequency		Degree of dominance	
	Birch stand	Spruce stand	Birch stand	Spruce stand
Peltigera sp.	1		+	
Nephroma arcticum	1		+	
Cladonia sp.	1		1	
Aulacomnium palustre	1		+	
Dicranum majus	8	6	4	1
Ptilium crista-castrensis		1		+
Pleurozium Schreberi	10	10	14	17
Hylocomium proliferum		10		52
H. splendens	8		6	
Polytrichum sp.	10	9	11	5
Barbilophozia lycopodioides	9	10	1	1
Brachythecium sp.	9		+	
Plagiothecium sp.	1		+	
Deschampsia flexuosa	9	9	22	8
Equisetum silvaticum	2		1	
Chamaenerium angustifolium	4		2	
Melampyrum pratense	10	6	3	1
Lycopodium annotinum	1		+	
Vaccinium vitis-idaea	10	10	12	26
V. myrtillus	10	10	59	58
Pirola secunda	1	1	+	+
Linnaea borealis	9	10	6	1
Empetrum nigrum	1	10	+	3
Ribes rubrum	1		+	
Litter	10	10	49	16

Both the different character of the forest litter, due not only to the different tree stand but also to the markedly different ground vegetation, and differences in humidity and temperature, probably account for the differences in the fauna.

The birch stand, according to SIRÉN, is warmer but drier than the spruce stand.

The birch *HMT* is thus a locality where *Neonothrus humicola,* which has previously been found only in Northern Sweden, is the dominant Camisiid species (cf. p. 32).

Myrtillus type (MT)

"The moss vegetation, as a rule, is abundant or continuous, but it is not as thickly luxuriant as in the Hylocomium-Myrtillus type, and its most important components are *Hylocomium proliferum, H. parietinum* and the various species of *Dicranum,* etc. The role played by lichens is very unimportant. Herb vegetation is more abundant and richer in species than in the *Hylocomium-Myrtillus* type, consisting mostly of quite common species. Grasses are comparatively few. The dominant *Myrtillus nigra* is nearly always accompanied by *Vaccinium vitis idaea.* In the natural state this forest type would always be covered by Norway spruce; but, owing to burning-over for cropping purposes, fires, fellings, etc., the Scots pine and birch occur very commonly as forest-forming trees, and in tracts where burning-over for cropping purposes has been much practised, also the grey alder (*Alnus incana*) and aspen (*Populus tremula*). Hardwood species of trees, as a rule, are not met with, except in regions where grass-herb forest types prevail, and whence hardwood species of trees have strayed to this type.

The Myrtillus type is very characteristic of the southern half of Finland." (CAJANDER 1926.)

The 100 samples of this type were taken in Kausala, rural district Iitti, on 5. VI. 1953; the forest there is spruce-dominated and *Calluna* is completely absent. The constancy values for the species recorded are included in Table 4.

Oxalis-Myrtillus type (OMT)

"This type represents a certain relatively self-contained intermediate form between the Myrtillus and the Oxalis-Majanthemum types. Moss vegetation is fairly abundant, but much scantier than in the Myrtillus type; lichens are of no significance. Grass vegetation is somewhat, and the herb vegetation much more abundant than in the Myrtillus type. Among the grasses and herbs, some more hygrophilous species, as *Oxalis acetosella* in particular, and *Melica nutans, Fragaria vesca,* etc. are also encountered. More exacting bushes (*Rubus idaeus, Daphne,* etc.), are often present. Among the common species of trees a sprinkling of hardwoods is often met with and sometimes they may even be dominant (e.g. the oak — *Quercus pedunculata,* — in Southwest Finland).

The forest type occurs on the more fertile lands of the southern half of Finland, being fairly common especially in valleys and on the lower slopes, although the areas covered by it are not very extensive." (CAJANDER 1926.)

The samples of this type were taken by the author in Kausala, rural district Iitti, on 12. VI. 1953. On the *OMT* in Kausala, the plant list includes the following common species: *Oxalis acetosella, Majanthemum bifolium, Hepatica triloba, Lycopodium selago,* and *Rhytidiadelphus triquetrus. Daphne mezereum* also occurs throughout this area — an indication of the fact that this is a rich *OMT* since this species is one of the indicator plants of the rich grass-herb forest type. Also the fairly abundant occurrence of *Dryopteris linneana* shows that this is a forest of rich type. This fact is also reflected in the fauna, as will be seen later. Of the trees the birch is dominant, and of large size. Spruce is in the process of spreading to this area from the adjacent spruce-dominated forest. Small individuals of *Populus tremula, Alnus,* and *Sorbus* are fairly abundant.

The number of samples was 100. The constancy values for the two Camisiid species recorded are included in Table 4.

The presence of *Nothrus palustris* indicates that the forest in question is to be regarded as a rich *OMT*, this species being, properly, an inhabitant of rich forests.

Oxalis-Majanthemum type (OMaT)

"Mosses rather scanty (*Hylocomium triquetrum*, various species of *Mnium*, etc.). Among dwarf-shrubs, *Myrtillus nigra* and *Vaccinium vitis idaea* are common, but generally in small numbers. Grasses and sedges are not very abundant (*Calamagrostis arundinacea, Aira caespitosa, Melica nutans, Carex digitata,* etc.), but the thin-leaved herbs (ferns, *Oxalis, Majanthemum, Convallaria majalis, Rubus saxatilis, Fragaria vesca,* various species of *Viola*, etc.), are in greater abundance. If the conditions of primeval forest obtained, Norway spruce would be the only dominant tree species; but in the conditions prevailing in Finland, the birch (*Betula verrucosa* and *B. odorata*) is, in most cases, the forest-forming tree, and in addition, in tracts where burning-over for cropping purposes has been practised, the grey alder (*Alnus incana*) as well as the aspen (*Populus tremula*), besides which hardwood species of trees also occur. In Finland, its distribution is nearly the same as that of *OMT*, but it is less common." (CAJANDER 1926.)

The samples have been taken by the author at Pasila, a suburb of Helsinki city, on 12. VII. 1953. The graminifolious species of the ground vegetation mentioned by CAJANDER are very abundant, and of the trees *Alnus incana* is dominant. *Populus tremula* is also common, and here and there some individual of *Sorbus* occurs. Of the bush species *Ribes alpinum* and *Corylus avellana* occur most abundantly.

The Camisiid fauna is almost completely identical, qualitatively as well as quantitatively, with that of the preceding *OMT* type. The number of samples is 100.[1] The constancy figures of the Camisiid species recorded are included in Table 4.

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[1] In addition to these samples, the author has collected a series of 100 samples from a *Corylus* thicket at Tvärminne, Hanko Peninsula, S. Finland, and a few samples from an oak wood at Gullö, Tammisaari, S. Finland. As these sample series give additional information about the Camisiid fauna of rich forests, they may be briefly described here (see footnote on the next page).

b. *Synopsis of the Camisiids of the different forest types*

An idea of the differences in the Camisiid fauna of the various forest types is obtained by a study of Table 4.

The tables reveal that the number of species is highest in *EMT* and *VT* and decreases towards the poorer as well as towards the more luxuriant types. In the two first-mentioned types there are 11 species in each, but actually *EMT* is richest in species, because, in the case of *VT*, the number of species has been relatively much increased by the great number of samples (824 samples of *VT*, as against 262 of *EMT* and 100 of the other types). This obviously leads to the discovery of some rare species which thus contribute to the total number, although they are of low constancy and would not have been found with a very small number of samples. If the species with constancy values lower than 1 are omitted, 9 species are left in *EMT* and only 4 in *VT*.

One of the reasons why the number of species is higher in *VT* and *EMT* than in the other types may also be the fact that samples of these types have been taken in various parts of the country, although the *EMT* samples come only from Northern Finland and those of *VT* from elsewhere, not from Northern Finland. The samples of the other types come from one place only. The distribution maps show, however, that no species has so limited a distribution as to have any considerable effect on the results.

Corylus thicket at Tvärminne. — The thickness of the humus layer varies considerably. In places there is scarcely any humus under the mosses, whereas it may be fairly thick in other places. This variability is due to the fact that the locality in question is very stony and rocky. Another consequence of this is that the locality is relatively dry.

Of the mosses in the ground layer the most abundant are *Rhytidiadelphus triquetrus* and *Rhodobryum roseum*, but *Plagiochila asplenioides* is also frequently encountered. The commonest plants in the herb stratum are *Melica nutans* and *Poa nemoralis*. The role of herbaceous species is very marked. Of the herbaceous species *Convallaria majalis, Primula veris, Silene inflata, Dianthus deltoides* and *Geranium sanguineum* are most common. Of the dwarf-shrubs some *Vaccinium myrtillus* is encountered. Of the bushes, *Corylus avellana* is dominant and very abundant. Now and again *Ribes alpinum* is also met with. The sparse trees include: *Populus tremula, Sorbus aucuparia, Betula verrucosa*, and *Juniperus communis*.

The number of samples is 100. They were collected on 25. VI. 1953. The constancy figures of the species recorded were:

Nothrus palustris	76	*Platynothrus peltifer*	25
N. silvestris	41	*Nothrus biciliatus*	1

Oak wood at Gullö, Tammisaari. — This woodland locality represents a modification of of the *OMaT*. Of the herbaceous species of the herb stratum *Melampyrum nemorosum* has spread as a continuous carpet all over the wood and actually smothered the growth of other species. Of the trees only old oaks (*Quercus robur*) occur, which lend the wood its shady character. *Corylus avellana* and *Prunus padus* grow on the borders of the wood.

There are only 4 samples, so that no constancy figures can be presented. *Nothrus palustris* and *Heminothrus paolianus* were recorded.

When arranging the localities according to moisture, a decrease of the number of species towards the moister types can be observed; in the rich forests there are 2 — 4 species only. Thus both in regard to its vegetation and its Camisiid fauna, and to the number of species and the constancy figures of the species recorded, *OMT* is an intermediate type between the rich forests and the other types dealt with (cf. CAJANDER 1930).

In the author's opinion, even when classifying the species according to their constancy in types belonging to the same formation, the well-known classification of BROCKMANN-JEROSCH (1907) can be used, where the species are classed as constant, accessory or accidental as follows:

Constant species: occurring in more than 50 %
Accessory ,, ,, ,, 25 — 50 %
Accidental ,, ,, ,, less than 25 % of the investigated samples of one and the same association.

Following the classification of LÜDI (1928), a regional constancy is here concerned. I shall give below, without the constancy figures, the Camisiid species belonging to the different groups. It should be understood that the grouping is the same as that of BROCKMANN-JEROSCH. This classification has also been used by KROGERUS (1932) and by KONTKANEN (1950).

On the dry heathy forests there are 5 constant species: *Nothrus silvestris, Heminothrus paolianus, H. targionii, Camisia lapponica,* and *C. scabra.* Accessory species include all the other species occurring on dry heathy forests. It may be said that the number of sub-categories of the dry heathy forests is small for such a study. This disadvantage is still greater in the case of the moist heathy forests, but one might possibly consider as constant species in the latter: *Nothrus silvestris, Heminothrus paolianus,* and *Camisia lapponica.* If the entire heathy forest formation is considered as a whole, the small number of types is no longer a limiting factor with regard to the reliability of the conclusions. We may then compile the following list:

Constant species: *Nothrus silvestris, Heminothrus paolianus, Camisia lappanica, Heminothrus targionii.*

Accessory species: *Camisia scabra, Neonothrus humicola, Platynothrus peltifer, Nothrus pratensis, Camisia spinifer, Nothrus borussicus, Camisia segnis.*

Accidental species: *Nothrus palustris, Platynothrus punctatus, P. capillatus* var. *septentrionalis.*

Of these species, KÜHNELT (1950) mentions *Nothrus silvestris* and *Heminothrus targionii* as species occurring particularly among forest mosses, but in Finland the other two above-mentioned constant species are also of this type. *Nothrus silvestris* is also one of the commonest species in the beech forests of the Netherlands. According to VAN DER DRIFT (1950) it is the commonest Oribatid after *Oppia neerlandica* in forests of this kind.

In the case of the rich forests it is likewise difficult to attempt a classification of the species, since there are only three types, but one might be justified in considering as constant the species *Nothrus palustris* and *N. silvestris*.

c. *Peatlands*

CAJANDER (1913) has classified the peatland vegetation in accordance with the same principle as the forests. In the choice and determination of the peatland types the author has used the handbook by LUKKALA and KOTILAINEN (1945). The descriptions of the peatland types are also in conformity with this work, regarding both the types from which samples have been obtained in connection with the transect survey work, and those from which samples were taken by the author. To the descriptions of the latter, as in the case of the forest types, I have added a note of some special features observed in each case. The descriptions of LUKKALA and KOTILAINEN (op.cit.), being short but nevertheless giving a fairly good idea of the type in question, are more suitable in this instance than the extensive and exhaustive descriptions of CAJANDER (1913).

With regard to the constancy figures of the Camisiid species occurring in the peatlands, it should be noted that a comparison between types based on such figures is valueless, as these figures cannot be accurate on account of the small number of samples. I have nevertheless computed them even in such cases because they reflect the mutual abundance relations of the different species within one and the same type.

Spruce-hardwoods peatland forests (Korvet, *K*)

Wooded peatlands where the tree stand — sometimes thin and of inferior growth — is made up of spruce or hardwoods, mainly birch. Occasionally willow thicket alone forms the tree stand. Pine is usually absent, and likewise, as a rule, shrubs. Dwarf shrubs (mainly *Vaccinium myrtillus* and *V. vitis-idaea*) are less abundant than on the *R* types, herbs are more abundant and in certain subtypes even very plentiful. The commonest and most abundant *Sphagnum* moss even in the *K* types is *S. recurvum* s. lat. In addition, species particularly characteristic of this peatland type are encountered: *S. Girgensohnii*, *S. riparium*, *S. squarrosum*, *S. Wulfianum*, *S. centrale*. A further common species is *S. robustum*, although it is equally abundant on the *R* types also. Of the other true mosses *Polytrichum commune* is particularly typical of the *K* types. Furthermore, *S. magellanicum* and feather mosses, etc., are met with, especially in elevated places.

Ordinary spruce-hardwoods peatland forest (Varsinainen korpi, *VK*)

The peatlands of this type represent the advanced stages of paludification of the moist heathy forest (*MT*, see above). Common in all subtypes, although often of sparse occurrence, is *Carex globularis*. The moss carpet, which is nearly continuous, is formed by *Polytrichum commune* and feather mosses, and in addition by *Sphagnum* mosses, primarily *S. Girgensohnii*, *S. recurvum*, in patches *S. robustum*, *S. magellanicum*, and more rarely *S. Wulfianum*.

The number of samples is 100 and they were taken in Niinimäki, rural district Iitti, on 24. VII. 1953. The peatland of considerable extent is of *Equisetum silvaticum* subtype. The trees are mainly spruce, but birch is also present in considerable abundance. The most remarkable species of the ground vegetation is *Equisetum silvaticum,* which occurs very plentifully. Of the dwarf shrubs, *Vaccinium myrtillus* and *V. vitis idaea* occur to some extent. *Rubus chamaemorus* is common, and likewise *Lycopodium annotinum*. Of the mosses, *Sphagnum Girgensohnii* is dominant, but *Polytrichum commune* and *S. squarrosum* are also of fairly general occurrence; in the hummocks *Hylocomium proliferum* is found and on the base of tree stems *Dicranum undulatum*.

The constancy figures for the Camisiid species are included in Table 4.

Pine bogs (Rämeet, *R*)

Usually bogs growing stunted pine forest, mostly rich in dwarf shrubs. In addition to *Andromeda polifolia, Oxycoccus quadripetalus* and *Betula nana,* also typical pine bog dwarf shrubs such as *Vaccinium uliginosum, Ledum palustre* and *Calluna vulgaris*. In the *IR* type of Eastern and Northern Finland: *Chamaedaphne calyculata*. Some subtypes also have some *Vaccinium myrtillus* and many of them *V. vitis-idaea*. Herbs are generally few. The main constituents of the moss cover are: *Sphagnum recurvum, S. magellanicum, S. robustum, Pleurozium Schreberi, Aulacomnium palustre, Polytrichum strictum,* less frequently *S. acutifolium, Polytrichum commune, Hylocomium proliferum*. In the *RSR* and *LR* types, moreover, mosses foreign to the normal *R* types occur.

Peaty pine forest (Kangasräme, *KgR*)

The peatlands of *KgR* type are stages of paludification of a fairly poor or poor woodland (*ClT* to *VT*, see above). The peat layer is usually rather thin.

The number of samples is 73, and they were obtained in connection with the transect surveys, as were those of all the other *R* types. Consequently, the constancy figures may be too small in those types where a greater number of samples were available. In the case of the types with only a few representatives the values may even be much too high. The constancy figures of the 7 Camisiid species of the *R* types (Table 4) should thus be used only for a comparison of the mutual abundance of the species within one and the same type.

Peatland forest intermediate between the spruce-hardwoods and pine bog type (Korpiräme, *KR*)

This type consists of *R* types more or less similar in character to the *K* types. In addition to mosses characteristic of the *R* vegetation there may also occur mosses of the *K* type (*S. Girgensohnii*). *S. robustum* seems to be particularly typical of *KR*. The forest is pine, nearing the timber stage and admixed with spruce, and sometimes also with birch. The peat is generally well decomposed nearly to the surface.

The number of samples is 58. The constancy figures of the 7 Camisiid species recorded are included in Table 4.

Pine bog with rich growth of various undershrubs (Isovarpuinen räme, *IR*)

These are the most typical pine bogs. The forest is more stunted than in the preceding type, but some of the pines usually grow to timber trees. Spruce is for the most part altogether absent or occurs as small isolated individuals. There is an abundance of various undershrubs characteristic of the *R* vegetation. Of the herbs only *Rubus chamaemorus* occurs, of the sedges *Eriophorum vaginatum, Carex pauciflora* and *C. globularis.* The moss flora consists of the species mentioned above in the general description of the *R* type. With the exception of some dwarf birch pine bogs, the peat is usually *Sphagnum* peat with remains of trees.

The number of samples was 86. The constancy figures of the 9 Camisiid species recorded are included in Table 4.

Ordinary Carex pine bog (Varsinainen sararäme, *VSR*)

The spaces between the hummocks are Sphagnum bog with sedge vegetation or *"rimpi"* bog with sedge vegetation, less frequently *Sphagnum papillosum* bog with sedge vegetation. The hummocks are rich in undershrubs, sometimes even slightly sphagnous (*S. fuscum*). The herbs are less dominant than in the preceding type, of the sedges *Carex dioeca* is absent, of the mosses *Sphagnum subsecundum.* Uneven pine forest, often admixed with birch, very variable in density and size.

The number of samples is 28. The constancy figures of the 4 Camisiid species recorded are included in Table 4.

Poorer quality Carex pine bog (Huonompi sararäme, *HSR*)

Combinations of the *N* and *R* types where the sedge-dominated interstices are of small area in comparison with the sphagnous hummocks, or where the entire surface of the bog is covered by a nearly continuous *Carex globularis* vegetation. The forest is thin and scattered, as on the better Carex pine bogs, but more pine-dominated.

The number of samples is 45. The constancy values of the 4 Camisiid species recorded are included in Table 4.

Eriophorum vaginatum pine bog (Niittyvillaräme, *NR*)

The bogs of this type are intermediate stages between the wet treeless *Eriophorum vaginatum* Sphagnum bog (generally the *LkN*) and the pine bog (not the *RR*) or combinations of these. In the moss flora *Sphagnum recurvum* and in the elevated places *S. magellanicum, Pleurozium, Polytrichum strictum,* etc., are dominant; in some cases *S. fuscum* even occurs to some extent.

The number of samples is 33. The constancy figures of the Camisiid species recorded are included in Table 4.

Eriophorum vaginatum pine bog with dominant Sphagnum fuscum (Rahkainen niittyvillaräme, *RNR*)

Bogs similar in character to those of the preceding type, but the hummocks consist of *Sphagnum fuscum* bog. In numerous instances nearly the entire surface of the bog is in process of being buried under a cover of this species. The forest is thin and composed of stunted pines.

The number of samples is 39. The constancy figures for the Camisiid species recorded are included in Table 4.

Sphagnum fuscum pine bog (Rahkaräme, *RR*)

The peatlands of this type are bogs growing stunted pine and are of a comparatively dry nature, with the exception of the boggy hummock pine bogs characterized by depressions, and their surface is covered by a fairly thick, poorly decayed *Sphagnum* peat layer. Nearly all dwarf shrubs of the *R* type occur, except *Chamaedaphne calyculata*. *Rubus chamaemorus* is very common. Of the graminifolious plants generally only *Eriophorum vaginatum* and *Carex pauciflora* are encountered. The dominant moss is *Sphagnum fuscum*, and in addition to this: *S. recurvum*, *S. magellanicum*, *Polytrichum strictum*, etc.

The number of samples is 18. The constancy figures for the Camisiid species recorded are included in Table 4.

Pine bog of fen type (Lettoräme, *LR*)

Combinations of pine bogs and fens, frequently of wide extent in calcareous and slaty regions. The hummocks are topped by dry fen vegetation dominated by *Sphagnum Warnstorfii*, *S. recurvum* and feather mosses, often also overgrown with *Sphagnum fuscum*. In the interstices fen undergrowth. On the hummocks generally juniper. Also characteristic of this type is *Eriophorum latifolium*. The same herbs occur as in the *Warnstorfii* fens and in the fen-like spruce-hardwoods peatland forests, altohough less abundantly. The relative areas of hummocks and interstices vary widely. The forest is pine-dominated.

The number of samples is 12. The constancy figures of the Camisiid species recorded are included in Table 4.

Wet treeless Sphagnum bogs (Nevat, *N*)

Treeless bogs where the ground water reaches nearly to the surface of the bog throughout the growing season or a large part of it. The bulk of the moss cover consists of Sphagna. Their species composition is very variable, depending on the height of the ground water; from the deepest hollows, the so-called *rimpis*, the *Sphagnum* mosses may even be absent. The chief constituents of the moss cover are *Sphagnum recurvum*, *S. papillosum*, and *S. cuspidatum* s. lat., and in the drier sites *S. fuscum*. The sedges are few as regards number of species, although they may occur in very great abundance of individuals. Of these there may be mentioned: *Carex lasiocarpa*, *C. rostrata*, *C. chordorrhiza*, *C. pauciflora*, *C. limosa*, *C. magellanica*, and *C. canescens*. Other sedge plants: *Eriophorum vaginatum*, *E. polystacheum*, *Scirpus trichophorum* and *S. caespitosus*. Even the herbs are very scanty. The most common are: *Scheuchzeria palustris*, *Menyanthes trifoliata*, *Comarum palustre*, *Equisetum limosum* (less frequently *E. palustre*), *Viola palustris*, *Pedicularis palustris*, and on the drier surface of Sphagnum bogs *Rubus chamaemorus*. The dwarf shrubs are relatively few; only *Andromeda polifolia* and *Oxycoccus quadripetalus* are common. Somewhat rarer is *Betula nana*, usually of lower growth on the *N* types than on the *R* types.

Water swamp (Vesineva, *VeN*)

Plant associations on the banks of stagnant or running waters with a non-continuous moss cover mostly floating on water.

Of the samples, totalling 200, 100 were taken at Tvärminne on 25. VI. 1953 and 100 in Helsinki on the shore of Vanhakaupunki bay, on 21. VII. 1953. It is interesting to note the striking similarily of the constancy figures for the Camisiid species recorded from these different localities:

Tvärminne	Constancy	Helsinki	Constancy
Heminothrus thori	85	*Heminothrus thori*	82
Platynothrus peltifer	77	*Platynothrus peltifer*	60
Nothrus silvestris	1	*Nothrus pratensis*	2

The constancy figures calculated on the basis of these sample series are included in Table 4.

Alluvial marsh (Tulvaneva, *TN*)

Meadow-like bogs which are periodically flooded. The moss cover is scanty as a result of the alluvial water, or is absent. Grasses and herbs occur in addition to sedges. Dwarf shrubs are generally absent.

The number of samples is 100 and they were taken in Kausala, rural district Iitti, in the surroundings of the pool Luhtalampi. Of the mosses there occur in greatest abundance: *Aulacomnium palustre, Sphagnum teres, S. recurvum*, and *S. papillosum*. The commonest of the grasses are: *Carex rostrata, C. magellanica, C. Goodenowii, C. limosa*, and *Juncus stygius*. The herbs: *Comarum palustre, Viola palustris, Caltha palustris, Melampyrum pratense*, and *Peucedanum palustre*. Of trees, in the entire alluvial marsh area only 3 — 4 stunted pines are encountered. The constancy figures for the Camisiid species recorded are included in Table 4.

Bog with low sedges (Lyhytkortinen neva, *LkN*)

The most significant species of the moss cover are *Sphagnum recurvum* and *S. magellanicum*; additionally there may occur *S. cuspidatum, S. rubellum, S. balticum, S. papillosum, S. fuscum*, etc., and in the hummocks sometimes *Polytrichum strictum*, even in great abundance. Of the vascular plants *Eriophorum vaginatum* is dominant, nearly as common as *Carex pauciflora*. Of the dwarf shrubs of the *N* types *Betula nana* is also remarkably common, and even *Chamaedaphne* occurs exceptionally in this type. The surface peat is usually rather poorly decayed *Sphagnum* peat containing remains of cottongrass.

The number of samples is 100, and they were taken from the bog at Pasila near Helsinki, on 12. VII. 1953. The *LkN* of Pasila is nearly treeless. Both in the spring and in the autumn it is almost entirely covered by water. Here and there some larger, dry hummock occurs which then fairly consistently bears a dwarf birch. Otherwise the surface is fairly even. Of the mosses, *Sphagnum balticum* is dominant. In the hummocky places, however, *S. fuscum* occurs in greater abundance. Even *S. rubellum* is present, but rather scantily. *Eriophorum vaginatum* grows sparsely. Of the dwarf shrubs only *Andromeda polifolia* and *Oxycoccus quadripetalus* are encountered. The constancy figures of the 2 Camisiid species recorded are included in Table 4.

Drained peatlands with vegetation of firm forest type (Turvekankaat)

In this class such remarkable changes toward the forest type have already taken place that the initial peatland type is no longer distinctly recognizable. *Sphagnum* mosses, and particularly *Polytrichum*, and in some cases dwarf shrubs of the *E* type as well as *Eriophorum vaginatum* and other plants of the peatland are still present in such amounts that the locality cannot be called a forest.

Drained peatland of Vaccinium type (Puolukkaturvekangas, *VTk*)

When drained, the peatlands of this type are of medium or slightly inferior quality. There is a growth of shrubs of *Vaccinium vitis-idaea* and less of *V. myrtillus*, some *Calluna*, various dwarf shrubs of the *E* type, cottongrass, a few sedges, still fewer grasses, some *Rubus chamaemorus*, feather mosses, *Dicranums*, hair-mosses (*Sphagnum recurvum, S. magellanicum, S. robustum*, etc.), some *Cladonia alpestris*. The forest is mostly pine-dominated.

The number of samples of this type is 100 and they have been taken from a fairly small area of this type on the southern edge of the Pasila bog near Helsinki city. As a result of drainage, this region has changed considerably in character during the last few decades. The bog has become drier than a pine bog, and the peat is fairly far decomposed. The very scanty vegetation of the ground and field layers can, in part at least, be attributed to the dense stands of rather tall pines. In addition to pines, small saplings of spruce grow fairly abundantly on the borders of the area. The ground layer consists almost exclusively of *Pleurozium Schreberi*, even this occurring only in places. Most conspicuous of the species in the herb stratum are *Vaccinium vitis-idaea*, which occurs here in somewhat greater abundance and is probably in process of extending its area, and *V. myrtillus*. *Ledum palustre* occurs very scantily.

The samples have been taken on 12. VII. 1953. The constancy figures of the Camisiid species recorded are included in Table 4.

d. *Synopsis of the Camisiids of the different peatland types*

The distribution of the Camisiid fauna in the different peatland types is best understood with the aid of Table 4.

The range of species of drained peatland of Vaccinium type is similar, with the exception of *Camisia lapponica*, to that of the firm forest lands with a cover of raw humus. In the *EMT C. lapponica* likewise has a high constancy, whereas it is very low in the other firm forest lands, but again relatively high in almost all the different peatland types.

The fauna of the drained peatland of Vaccinium type shows that in the transition of a peatland to forest land the fauna of the type in question also changes, to correspond to the new type.

Nothrus silvestris is of a high constancy on the *VTk* type which resembles as regards its fauna the firm forest lands, on the *K* type, and also among the pine bog types in the *KR* type. In the case of the *RSR* type the constancy of *Nothrus pratensis* is given in brackets on account of the small number of samples; the same has been done with *Camisia segnis* because this species was found in the quantitative samples which were divided vertically into several layers so that they are not mutually equivalent with regard to constancy. However, this species has been included in the list for the sake completeness.

The classification into constant, accessory and accidental species in accordance with the principle already employed in the case of the forest types (p. 36) gives the following results in the case of the *R* types:

Constant species: *Nothrus pratensis, Heminothrus paolianus, Camisia lapponica.*

Accessory species: *Nothrus silvestris, Neonothrus humicola, Camisia scabra.*

Accidental species: *Nothrus borussicus, Platynothrus peltifer, Heminothrus targionii, Camisia segnis.*

In the wet treeless Sphagnum bogs the number of types is too small to allow of a study of this kind. Considering the size of the constancy figures, however, one might regard *Nothrus pratensis* and *Platynothrus peltifer* as constant species in the bogs of the *N* type. The treating of all peatland formations as one whole will yield the following list, which is slightly different from that applying to the *R* type alone:

Constant species: *Nothrus pratensis, Heminothrus paolianus, Camisia lapponica, Nothrus silvestris.*

Accessory species: *Platynothrus peltifer, Neonothrus humicola, Camisia scabra.*

Accidental species: *Nothrus borussicus, Camisia spinifer, Heminothrus thori, H. targionii, Camisia segnis.*

D. SYNOPSIS OF THE CAMISIID FAUNA OF THE FOREST AND PEATLAND TYPES AND OF ITS DISTRIBUTION

Table 4 gives a synopsis of the occurrence of the species belonging to the family *Camisiidae* in the localities investigated. One of the columns of this table gives, in abbreviated form, the general ecological range of the species in question (stenotopic, eurytopic or ubiquitous). It is true that this classi-

Table 4. Constancy values of the Finnish Camisiid species in different forest and peatland types. Cf. the data reported for a *Corylus* thicket and an oak wood, page 42. In the first column, E = eurytopic, S = stenotopic and U = ubiquitous species.

		Dry heathy forests				Moist heathy forests		Rich forests		*K*	*R*									*N*			Drained peatlands
		CIT	*CT*	*EMT*	*VT*	*HMT*	*MT*	*OMT*	*OMaT*	*VK*	*KgR*	*KR*	*IR*	*VSR*	*HSR*	*TR*	*RTR*	*RR*	*LR*	*VeN*	*TN*	*LkN*	*VTk*
Nothrus silvestris	U	87	62	13	54	—	88	11	10	58	8	14	2	4	—	—	5	—	—	1	—	—	62
N. pratensis	U	—	—	2	1	1	—	—	—	78	33	53	56	61	76	73	64	78	83	1	14	92	—
N. palustris	S	—	—	—	—	—	—	9	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Camisia scabra	E	—	3	2	3	—	—	—	—	—	1	2	2	—	—	3	—	—	—	—	—	—	8
C. spinifer	E	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10
C. lapponica	U	2	1	11	3	2	8	—	—	—	10	5	12	—	18	6	10	17	8	—	1	6	41
C. segnis	E	—	1	—	×	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—	—	—	—
Heminothrus paolianus	U	11	72	31	19	15	15	—	—	6	11	14	12	7	9	9	21	28	—	—	—	—	8
H. thori	S	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	84	—	—	—
H. targionii	E	2	1	×	—	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Neonothrus humicola	E	—	—	7	1	29	—	—	—	—	4	3	2	4	2	—	—	—	—	—	—	—	—
Platynothrus peltifer	U	—	—	1	1	41	—	—	—	42	—	2	2	—	—	—	—	—	—	68	33	—	—
P. punctatus	S	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
P. capillatus	S	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nothrus borussicus	E	—	—	3	×	—	—	—	—	—	1	—	3	—	—	—	—	—	—	—	—	—	2

fication, introduced by Dahl (1921), is rather difficult to apply to the localities concerned in this work, and the classification could have been made in several ways, since it is by no means easy to decide which of the localities are similar to each other. With regard to the tree stand, for instance, the dry wooded forest lands fairly closely resemble the *R* types, and similarly the moist forest lands of *K* type, but on the other hand they differ completely in regard to moisture and the vegetation of the ground layer, etc. There are few such localities among those investigated above which have anything in common, and thus the number of eurytopic species is quite high. As a rule *Camisia lapponica* occurs only in localities where the tree stand is made up of pine, but since it is also encountered in the *N* type and since the *TN* type, particularly, is entirely different from the other habitats of this species, is has to be classified among the ubiquists. Several of the species occur both in the heathy forest land and *R* types (*Neonothrus humicola, Heminothrus targionii, Camisia segnis* and *Nothrus borussicus*), some others in these two types as well as in the *VTk* type (*Camisia scabra* and *C. spinifer*). As these types closely resemble each other in quite a few respects — their relationship is also borne out by the fact that heathy forest land is transformed, through paludification, into *R* type and this latter again through draining into drained peatland — the above-mentioned species have to be considered eurytopic. *Nothrus palustris,* again, is a stenotopic species, since it occurs, in addition to the heathy forest types, only in *OMT,* which is very closely related to the rich forests. *Heminothrus thori* is a distinctly stenotopic species, but regarding *Platynothrus punctatus* and *P. capillatus* it is difficult to make any definite statement on account of their rarity, even though they have been recorded as stenotopic species in the table. Their classification may thus change when and if new finds are made. In addition to *Camisia lapponica,* the species *Nothrus silvestris, Heminothrus paolianus, Platynothrus peltifer* and *Nothrus pratensis* are ubiquitous. It is true that the last-mentioned is a typical species of peatlands (with the exception of *VTk*) and that it occurs indeed with quite low constancy figures in the heathy forest lands (*EMT*: 2, *VT*: 1, *HMT*: 1), but since this species is nevertheless also found in the heathy forest lands in addition to the *K* types, *R* types and *N* types, it has to be classified as ubiquist.

5. INFLUENCE OF SOME ENVIRONMENTAL FACTORS UPON THE CAMISIID SPECIES AND POPULATIONS

A. TECHNIQUE OF INVESTIGATION

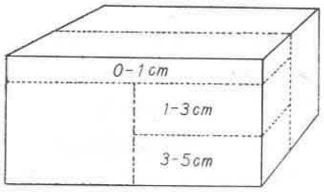
In the following investigations, with the exception of those concerned with the ecological valence of the various species, quantitative samples of the same size as the qualitative samples were used, but they were subjected to a different treatment.

The description of the general techique of sampling (p. 4) already contains a survey of the method employed to separate the animals from the soil samples in the quantitative investigations. At one time this method was considered very reliable. TRÄGÅRDH (1910 a) when reviewing the technique of sampling, mentions that in the opinion of BERLESE not a single living organism would escape the collecting vessel when employing his technique. Gradually, however, investigators began to have doubts as to the accuracy of this apparatus, and the investigation by FORSSLUND (1948) showed plainly that the results, in some respects at least, are anything but quantitative. FORSSLUND noticed that the size of the sample is of great significance with regard to the reliability of the results. Their accuracy increases with decreasing size of the sample, but a lower limit is put to the size of the sample by the fact that the numbers of individuals obtained from too small samples tend to give an incorrect picture of the quantitative relations of the different species. In the case of the larger mites and those with a thicker cuticle, FORSSLUND arrived at an optimum sample size of 26 cc. For smaller animals he considered it essential to devise an apparatus which would not be based on the drying of the sample, since the small species and those with a thin cuticle dry up before they have time to emerge from the sample. Another factor which produces errors in the BERLESE funnels is the fact that a considerable number of animals, particularly the thin-cuticled Oribatids, Thrombidids and Collemboles, stick to the funnel. The best conception of the number of animals involved is obtained from the table published by FORSSLUND (1948).

According to FORSSLUND, the percentage of animals remaining in the funnel is 0.8 % in the case of the Camisiids, which are Oribatids with a thick cuticle; this figure applies in the case of samples 50 cc. in size. This figure is not large enough to affect the quantitativeness of the results, particularly when it is remembered that the figure given refers to thick-cuticled Oribatids in general, including numerous species of smaller size than the Camisiids. Now it is quite obvious that an individual will more easily be caught on the surface of the funnel, which is sticky from the alcohol evaporated from the collecting dish, if it has a smaller mass and a thinner cuticle.

For the present study the 10 × 10 × 5 cm soil samples taken in the way described above (p. 5) were sectioned vertically into three layers for the quantitative investigations. The topmost layer (0 — 1 cm in Fig. 13) consists of the 1 cm thick surface layer, the second layer of the next 2 cm below this (1 — 3 cm in Fig. 13), the third layer comprising the lowest section of the sample, also 2 cm in thickness (3 — 5 cm in Fig. 13). From the topmost layer I have cut a piece of 50 cm^2 area, from the two other layers pieces 25 cm^2 in area. Thus each sample ultimately had a volume of 50 cc. Fig. 13 shows the method of making the successive cuts.

Thus, in the subdivision of the soil into several layers, the natural division into the *S*, *F* and *H* layers employed by FORSSLUND (1943) has not been used; instead, the division is completely mechanical. The reason for such a



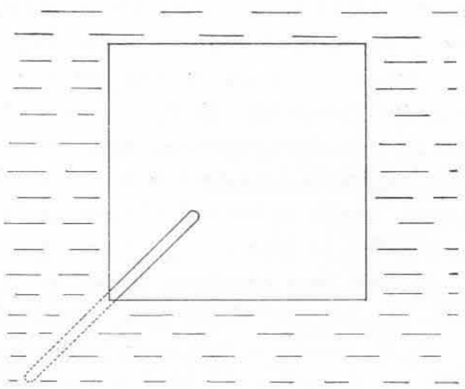


Fig. 13. Schematic drawing showing the cutting of the soil samples.

Fig. 14. View from above of the hole after removal of the soil sample, showing the insertion of the thermometer in a corner for measurement of the soil temperatures of the various layers.

decision was that the *S*, *F* and *H* layers encountered in most forest types cannot be discerned in all types, e.g. not in the peatland types. If one was to distinguish between such layers in the forest types and not in the case of the peatland types, there would be no way to establish a comparison between the results. On the other hand the purely mechanical division described makes possible the study of the vertical changes in abundance of the different species in all types and also the comparison of the results from different types.

Simultaneously with the sampling, climatic observations were also made in connection with some of the sample series. In connection with all the quantitative sample series the soil temperature in the different layers was measured. This was done, after the soil sample was lifted out, by inserting a small routine type thermometer horizontally in the untouched soil at one corner of the hole left by the sample, at depths of 0.5, 2, and 4 cm below the surface (Fig. 14). It is best to measure the temperature at the corner, since this is the place where the least change of temperature due to the excavation will occur.

From the soil samples taken in 1950, the water content was determined as a percentage of the fresh weight. As Forsslund (1943) has stated, the values obtained in this way are wholly comparable only where the dry substance of the samples are of equal specific gravity. Forsslund has determined the moisture content in terms of weight per unit volume. H. Krogerus (1948) also followed the same procedure in his investigation of beach insects. This is an excellent method if the samples are such that their volume can be determined accurately, but in my opinion it cannot be used to advantage in the case of the peatlands, where the volume of the samples cannot be accurately determined. Therefore to render comparisons more reliable the old percentage method was employed in the case of the forests and peatlands.

In evaluating the ecological valences of the different species it also proved necessary to measure the pH of the different types. These measurements were performed in the Sedimentary Deposits Laboratory, Geological Survey of Finland. 4 determinations were made for each type.

B. INFLUENCE OF THE GROUND VEGETATION UPON THE CHOICE OF HABITAT

In order to investigate why the species display such a very non-uniform distribution even within one and the same locality, a sample series was taken from the pine bog of Pasila in 1950. Sample areas were selected where some particular plant species either occurs alone or is at least dominant. In this way 4 habitats were selected. The results have been compiled in Table 5. Since this sample series was taken very late in the autumn, another series was taken the following summer, between 29. IV. — 26. VIII. 1951. In this case there were 6 different sample plots (Table 6).

Computing the number of individuals for the different sample plots from the more extensive series of 1951, we obtain the following table:

Sample plot	Number of individuals	% of total no. of individuals
L.	65	14
Cl.	153	32
D.	84	18
Sph.	120	25
Call.	51	11
P.	2	<1

It is thus seen that in the *P.* habitat only the abundance of Camisiids is distinctly lower than in the others. This is certainly partially due to the fact that this habitat is somewhat drier than the others even though it is not as dry as the dry forest lands. It can be concluded that moisture conditions cannot be the main reason for the small number of animals. There cannot be any influence due to soil acidity either, since the results of the pH measurements are as follows:

L.	3.7	*Sph.*	3.6
Cl.	3.4	*Call.*	3.7
D.	3.6	*P.*	3.5

The comparatively small variation of the pH values may be due to the high water content of the bog in question. From these considerations it appears that the most reasonable explanation for the low abundance of Camisiids in the *Polytrichum* habitat would be that the products of decomposition of the

Table 5. Distribution of 3 species of Camisiids within a single locality in relation to some plant species. — *D*: sample plot with nearly exclusively *Dicranum bergeri*; *Call.*: sample plot where the moss stratum is covered by dense *Calluna vulgaris* vegetation; *Cl.*: sample plot with abundant *Cladina rangiferina* among mosses, but without *Calluna*; *Sph.*: sample plot with *Sphagnum recurvum* only, without dwarf shrubs.

Sample plot	Depth, cm	*Nothrus pratensis*										*Camisia lapponica*										*Camisia scabra*									
	Date	1. X	8. X	15. X	22. X	29. X	6. XI	26. XI	3. XII	3. XII	Total	1. X	8. X	15. X	22. X	29. X	6. XI	23. XI	3. XII	3. XII	Total	1. X	8. X	15. X	22. X	29. X	6. XI	26. XI	3. XII	3. XII	Total
D.	0—1		6							1	7	1				2	2	1		1	7										—
	1—3		1			2	3	1	1	1	9										—										—
	3—5		3		4	1	2		1		11										—										—
	Total	—	10	—	4	3	5	1	2	2	27	1	—	—	—	2	2	1	—	1	7	—	—	—	—	—	—	—	—	—	—
Call.	0—1		1	1		1					3						2	1			3			2	2				1		5
	1—3	1				2	1				4	1			2						3										—
	3—5					1					1										—										—
	Total	1	1	1	—	4	1	—	—	—	8	1	—	—	2	—	2	1	—	—	6	—	—	2	2	—	—	—	1	—	5
Cl.	0—1			1		1					2			2		1	1	1		4	9		1				2	2		3	8
	1—3							1	2		3										—										—
	3—5										—										—										—
	Total	—	—	1	—	1	—	1	—	2	5	—	—	2	—	1	1	1	—	4	9	—	1	—	—	—	2	2	—	3	8
Sph.	0—1		2	1	1						4			2		1	1				4										—
	1—3				2		2			2	6			1							1										—
	3—5										—										—										—
	Total	—	2	1	3	—	2	—	—	2	10	—	—	3	—	1	1	—	—	—	5	—	—	—	—	—	—	—	—	—	—
All sample plots, Total		1	13	3	7	8	8	2	2	6	50	2	—	5	2	4	6	3	—	5	27	—	1	2	2	—	2	2	1	3	13

plant itself, i.e., of *Polytrichum,* are not suitable as nutriment either for the mites or even for the mycelia of fungi, with the result that the habitat is poor in food material. This is in my opinion one of the most important factors involved in the question of why the species show a non-uniform distribution even within one and the same locality. Quite frequently I have made the observation that, in the MT, individuals of a certain species may occur very abundantly in one sample, whereas the same species is not encounntered at all in another sample taken at the same time in the immediate vicinity of the first-mentioned. The cause of such occurrences is thus most probably an inequality in the abundance of food material, and usually not — or at least not directly — other edaphic factors such as acidity or moisture content.

Table 6. Distribution of some species of Camisiids within a single locality, in relation to some plant species. *L.*: sample plot with *Ledum palustre* and uniform though not very abundant growth of *Eriophorum vaginatum*; *P.*: sample plot with only *Polytrichum commune.* Other habitats as in Table 5.

Nothrus pratensis

Sample plot	Depth, cm	Date	29. IV	6. V	13. V	20. V	27. V	3. VI	10. VI	16. VI	25. VI	1. VII	8. VII	15. VII	22. VII	29. VII	5. VIII	12. VIII	19. VIII	26. VIII	Total
L.	0—1			5	5	4	7	2	1					5			1	1	13		44
	1—3			6	2														3	1	12
	3—5			1			1														2
Total			—	12	7	4	8	2	1	—	—	—	—	5	—	—	1	1	16	1	58
Cl.	0—1		1	2	17	4		3			2	14	5	4		3	5	13	7	6	86
	1—3		5		16	2	1	3						2	3	2	6			8	48
	3—5			1	2							1									4
Total			6	3	35	6	1	6	—	—	2	15	5	6	3	5	11	13	7	14	138
D.	0—1				3	1	1		2			2		2	11	1	2		4	1	30
	1—3				2				3					1	3		7		3	1	20
	3—5								1								11				12
Total			—	—	5	1	1	—	6	—	—	2	—	3	14	1	20	—	7	2	62
Sph.	0—1		6	1	2	4	15	4	1	4	2	2	1	1		1	1	2	2		49
	1—3		1	5		2	1	2	7		1			1	3	3	1		2		29
	3—5								4							1					5
Total			7	6	2	6	16	6	12	4	3	2	1	2	3	5	2	2	4	—	83
Call.	0—1													22	1				1		24
	1—3												1	3	1						5
	3—5													2							2
Total			—	—	—	—	—	—	—	—	—	—	1	27	2	—	—	—	1	—	31
P.	0—1																1				1
All sample plots, total			13	21	49	17	26	14	19	4	5	19	7	43	22	11	35	16	35	17	373

Table 6 (cont.)

Camisia lapponica

Sample plot	Depth, cm	Date	29. IV	6. V	13. V	20. V	27. V	3. VI	10. VI	16. VI	25. VI	1. VII	8. VII	15. VII	22. VII	29. VII	5. VIII	12. VIII	19. VIII	26. VIII	Total
L.	0—1									1	1										2
	1—3		1																		1
Total			1	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	3
Cl.	0—1		4						1		1								1		7
	1—3		1	2			2	1				1									7
Total			5	2	—	—	2	1	1	—	1	1	—	—	—	—	—	—	1	—	14
D.	0—1				1																1
	1—3				1			1	2	3		1			2		1	1	1	1	14
	3—5										4		1		1						6
Total			—	—	2	—	—	1	2	3	4	1	1	—	3	—	1	1	1	1	21
Sph.	0—1				1				4					1				1			7
	1—3		1		1	2		3	1	4	2	4		1	1		2			3	25
	3—5						1	2					1								4
Total			1	—	2	2	1	5	5	4	2	4	1	2	1	—	2	1	—	3	36
Call.	0—1														1	2					3
	1—3								1					2	1				1		5
Total			—	—	—	—	—	—	1	—	—	—	—	2	2	2	—	—	1	—	8
P.	3—5																			1	1
All sample plots, total			7	2	4	2	3	7	9	8	8	6	2	4	6	2	3	2	3	5	83

Heminothrus paolianus var. *longisetosus*

D.	0—1						1														1
Call.	0—1			1					2	1						2				2	8
All sample plots, total			—	1	—	—	1	—	2	1	—	—	—	—	—	2	—	—	—	2	9

Camisia scabra and ( ) *Camisia segnis*

L.	0—1		2					(1)			1										3 (1)
Cl.	0—1					1															1 (—)
Call.	0—1				(1)			1												1	2 (1)
All sample plots, total			2	—	(1)	1	—	(1) 1	—	—	1	—	—	—	—	—	—	—	—	1	6 (2)

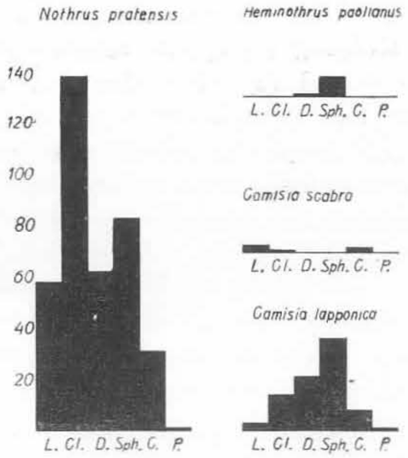


Fig. 15. Distribution of some Camisiid species in the different habitats of a pine bog at Pasila, near Helsinki.

As will be seen from table 6, the number of individuals is rather high in the other sample plots, except the habitat *P.*, and it is actually not possible to single out any one of the other habitats as being distinctly more favourable in its conditions. It is true that the *Cl.* habitat appears to be the best, but even this is not far ahead of the *Sph.* habitat; moreover, in the smaller material of the late autumn of 1950 the *D.* habitat proved the most favourable (38 %), *Cl.* coming only second (24 %).

The relation of the different species to the sample plots is seen from Table 7, where the abundances and constancies of the species have been given.

Table 7. The abundance and constancy of the different Camisiid species in sample plots of the pine bog with different ground vegetation. Abbreviations in Tables 5 and 6.

	Abundance at the depth of 0 — 5 cm per 1000 cc.						Constancy					
	L.	*Cl.*	*D.*	*Sph.*	*Call.*	*P.*	*L.*	*Cl.*	*D.*	*Sph.*	*Call.*	*P.*
Nothrus pratensis	22	51	23	31	12	<1	61	89	61	94	22	6
Camisia lapponica	1	5	8	13	3	<1	17	44	66	83	28	6
Heminothrus paolianus	—	—	<1	—	3	—	—	—	6	—	28	—
Camisia scabra	<1	<1	—	—	<1	—	11	6	—	—	11	—
C. segnis	<1	—	—	—	<1	—	6	—	—	—	6	—

Camisia scabra and *C. segnis* were found in such small numbers in these sample series that it is difficult to tell which habitat they prefer, but it seems as if the *L.* and *Call.* habitats were the most important; both are habitats growing dwarf shrubs of considerable size.

One may notice in a study of the distribution of the Camisiid species in the different habitats that only in the *Call.* habitat are all species represented, even though neither of the commonest species reaches its greatest abundance there. Consequently conditions seem to be such in the *Call.* habitat that even species of a low ecological valence can exist there. Fig. 15 shows the distribution of the species in the different habitats.

The above observations indicate that a special procedure should be followed in studying the species composing the fauna of forests or peatlands, unless the ground vegetation shows an entirely uniform distribution. The samples should be taken from an area where the ground vegetation is typical of the locality in question, or else samples should be taken from several sample plots of one and the same locality chosen so as to be representative, as a whole, of the vegetation characteristic of this locality.

C. EFFECT OF CHANGES IN TEMPERATURE AND MOISTURE

The results of temperature recordings made in connection with the taking of samples in the different localities are shown in Figs. 16 — 20. In Figs. 16 — 18 the recordings made in 1950 have been plotted, whereas Figs. 19 — 20 represent the 1952 — 53 measurements. The temperature of the surface layer varies greatly in accordance with the cloudiness. At a depth of 3 — 5 cm the daily changes of the air temperature no longer have any appreciable influence, and the temperature is mainly determined by the season, as is evident from the fairly smooth course of the curve. The temperature changes are also closely related to the changes in moisture, since higher temperature is accompanied by a higher rate of evaporation. The variations of moisture in the *R*, the *N* and the *MT* are shown in Figs. 21, 22 and 23, respectively. With regard to moisture, too, the greatest variation is observed in the surface layer. This is more distinct in the case of the drier localities. Thus it is seen that the moisture varies, in the *MT*, between 13 % and 74 % at 0 — 1 cm depth, but between 30 % and 71 % at 3 — 5 cm depth. In the locality with the highest water content, the *LkN*, the moisture varies between 81 — 95 % at 0 — 1 cm and between 87 — 95 % at 3 — 5 cm depth.

The effect upon the fauna of a long spell of fine weather, i.e., high temperature with simultaneous drought, is clearly seen on comparison of the weather recordings made in 1950 with the number of individuals found in the respective samples. The one and only long dry spell of the summer in question commenced even before the observations made on 13. VIII and lasted for more than three weeks; thus a second observation date (27. VIII) also fell within this period. In the diagram of the *MT* this drought is manifested as a decrease of moisture from its normal 40 — 50 % to a value as low as 13 %. If we consult Tables 8, 9, 10 and 11, it will be seen that in Table 12, which gives the number of individuals of *Nothrus silvestris* and *Heminothrus paolianus* in the *MT*, a downward migration of both species is distinctly noticeable. *Nothrus silvestris*, which generally occurs abundantly both in the 0 — 1 and in the 1 — 3 cm layers, has in part moved down as far as the 3 — 5 layer, and does not occur at all in the surface layer. *Heminothrus paolianus*, which

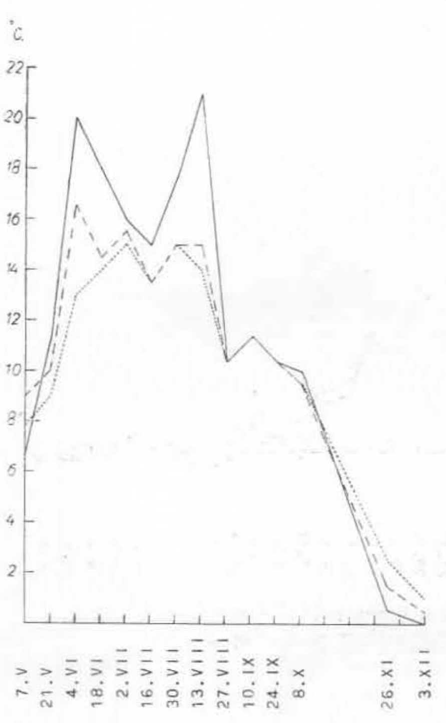


Fig. 16.

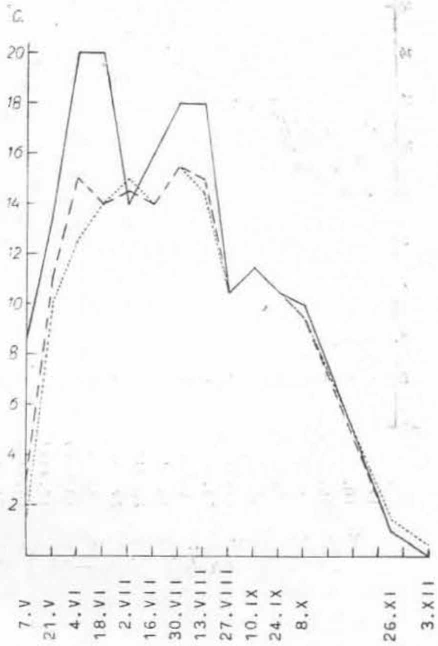


Fig. 17.

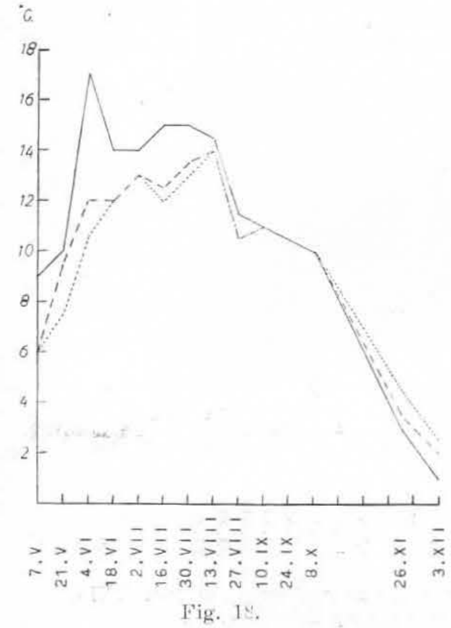


Fig. 18.

Fig. 16. Seasonal course of temperature on a pine bog at Pasila, near Helsinki, on 7. V. — 3. XII. 1950. ——— = 0 — 1 cm, — — — = 1 — 3 cm, ········ = 3 — 5 cm depth.

Fig. 17. Seasonal course of temperature on a wet treeless Sphagnum bog at Pasila, near Helsinki, on 7. V. — 3. XII. 1950. Explanations as in Fig. 16.

Fig. 18. Seasonal course of temperature on a forest of *MT* at Pasila, near Helsinki, on 7. V. — 3. XII. 1950. Explanations as in Fig. 16.

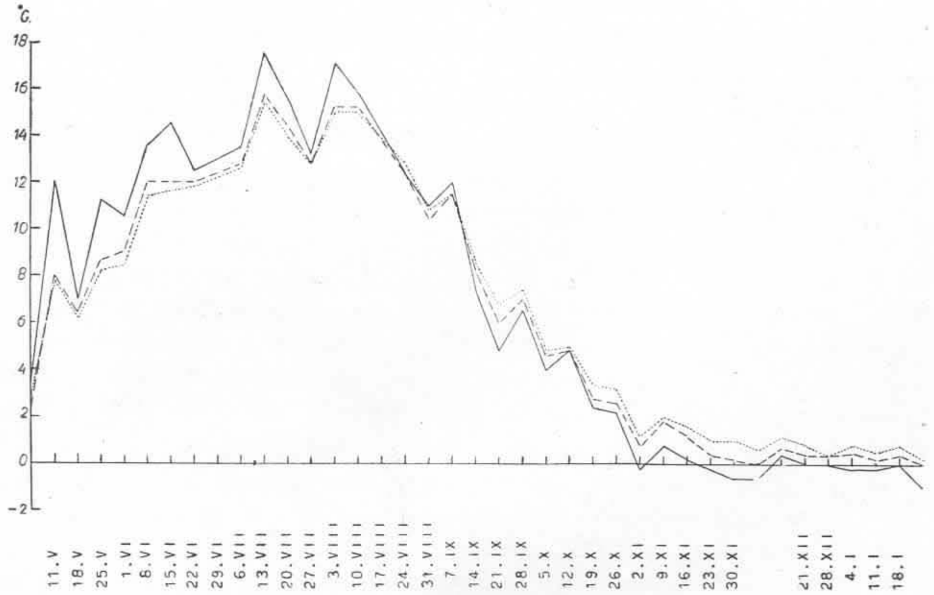


Fig. 19. Seasonal course of temperature in a forest soil of *OMT* at Iitti (EH), on 4. V. 1952 — 25. I. 1953. Explanations as in Fig. 16.

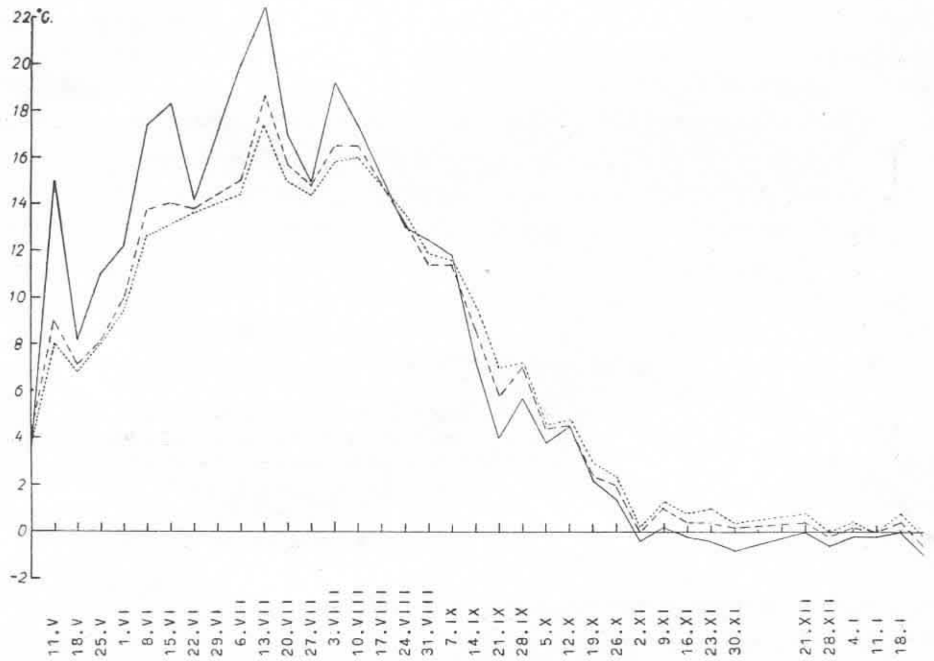


Fig. 20. Seasonal course of temperature on an alluvial marsh at Iitti (EH), on 4. V. 1952 — 25. I. 1953. Explanations as in Fig. 16.

Fig. 21. Changes of soil moisture an pine bog at Pasila, near Helsinki, on 7. V. — 8. X. 1950. Explanations as in Fig. 16.

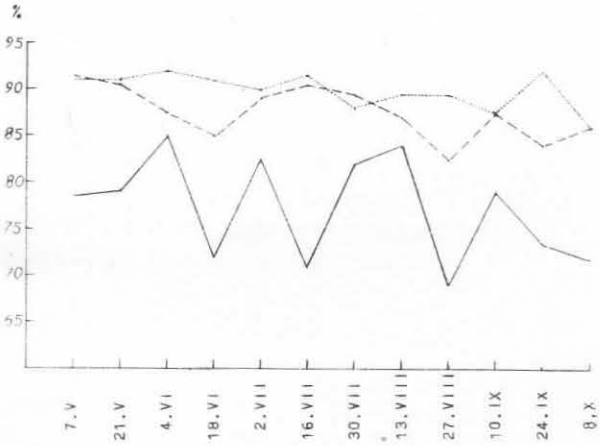
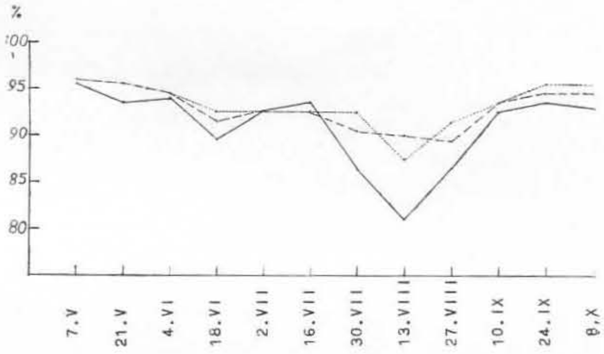


Fig. 22. Changes of soil moisture on a wet treeless Sphagnum bog at Pasila, near Helsinki, on 7. V. — 8. X. 1950. Explanations as in Fig. 16.



usually occurs mainly in the surface layer, has moved to the 1 — 3 cm layer. A similar migration seems even to have been caused by the decrease of moisture in the surface layer to 37 % on 4. VI. If the numbers of individuals found in the *LkN* are considered from this viewpoint, it is seen that the small decrease in moisture from the normal 92 — 93 % to 81 % which has taken place in this type did not produce any changes in vertical distribution.

The changes in vertical distribution described above are primarily the result of drought. High temperature alone is scarcely able to evoke them. On the other hand, the seasonal changes in temperature cause remarkable variations in the vertical distribution, and here there is no question of drought, since in the autumn, with a ground frost, the soil has a very high moisture content. The most critical phases from the viewpoint of the microfauna seem to be the formation of ground frost and its thawing. At these times the microfauna moves about. This movement is mainly towards the surface layer in the spring, but it is even the direct opposite in the case of certain species. In the autumn the trend is chiefly towards the deeper soil layers, but again also in some species towards the surface. A similar vertical movement has also been noticed

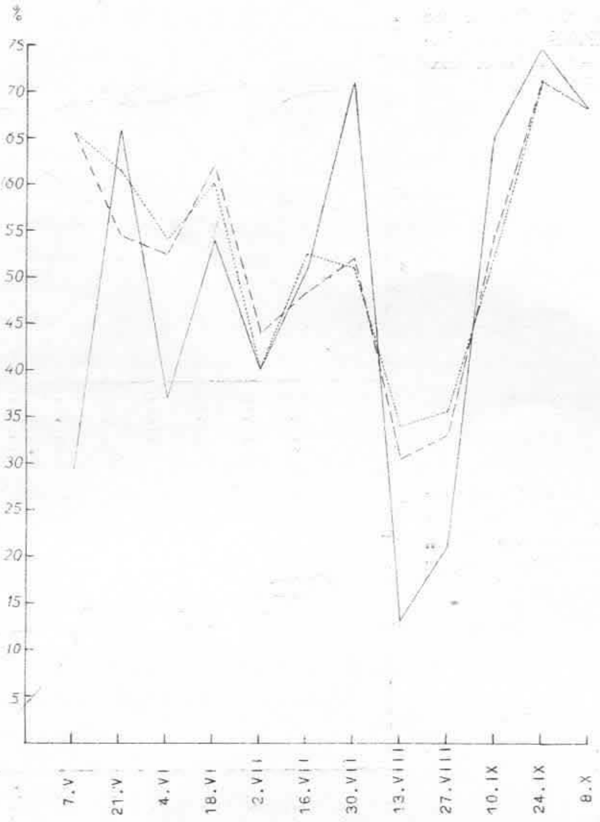


Fig. 23. Changes of soil moisture on a forest of *MT* at Pasila, near Helsinki, on 7. V. — 8. X. 1950. Explanations as in Fig. 16.

in Lapland by Agrell (1941) in many Collemboles, but Frenzel (1936) did not observe any such phenomenon on the meadows in Germany.

Fig. 24 shows the vertical distribution in summer and winter of some of the commonest Camisiid species. *Camisia lapponica* seems to display exceptional behaviour; in the spring and autumn it moves vertically in a direction opposite to that of the other species as a rule. The species is boreo-alpine and this may quite well account for its unusual behaviour. In the summer, when the deeper soil layers have a lower temperature, a considerable percentage of the individuals of this species are found at 1 — 5 cm depth, while at the onset of winter a considerable proportion of them may move up to the surface layer, even when this is frozen. In the diagram (cf. Karppinen 1952) the vertical distribution of *Nothrus pratensis* has also been shown for the same periods, i.e., the summer period 6. V — 26. VIII 1951 and the early winter period 1. X — 3. XII 1950, on the basis of samples from one and the same type, the pine bog. *Nothrus pratensis* is a species displaying similar

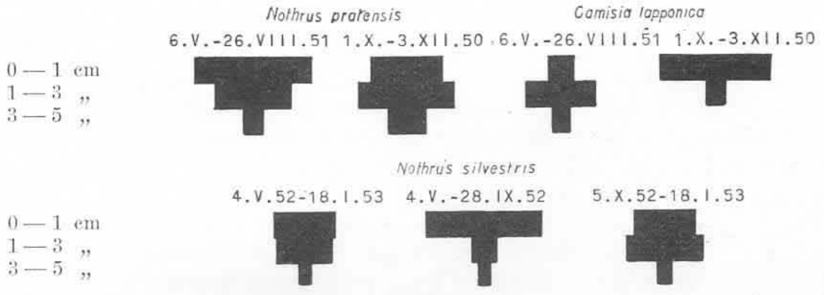


Fig. 24. Vertical distribution of some of the commonest Finnish Camisiid species in summer and winter.

behaviour at the onset of frost as the majority of other species. It distinctly penetrates downwards into the deeper soil layers, where the temperature is higher in wintertime than in the surface layer. This vertical migration is naturally also dependent upon the locality concerned. Thus, for instance, in the *VTk* type, which is also a peatland type, the vertical movement of the Camisiid individuals is the same as in the *R* type, as is evident from Table 9. In the alluvial marsh, however, no vertical variations can be observed with regard to the Camisiids occurring there. It seems as if in the case of certain species the vertical movement due to the changes in temperature caused by the seasonal variations did not occur in all soil types. For instance, no vertical movement is observable in the *MT* (Table 10) in the case of *Nothrus silvestris. Heminothrus paolianus* has not been found at all in my investigations after 8. X. In the *OMT, Nothrus silvestris* distinctly moves downwards before the winter (Fig. 24). *Nothrus palustris,* which is present in the same type, does not penetrate deeper even at the onset of winter, and this results in a smaller constancy of this species owing to the annihilation of individuals. STRENZKE (1952, p. 28) has observed that *Nothrus silvestris* also migrates to deeper layers

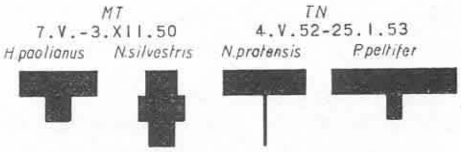


Fig. 25. Vertical distribution of some common Camisiid species.

in response to the influence of temperature variations. In the conditions prevailing in this country, the migration is thus dependent upon the location. The sample series which I took from *VTk* between 29. X and 3. XII 1950 (Table 9) shows that in this locality, too, *Nothrus silvestris* withdraws into deeper layers at the onset of winter. During the period referred to, altogether 7 individuals of this species were found at 0 — 1 cm depth, 11 at 1 — 3 cm and 15 individuals at 3 — 5 cm. *Camisia lapponica* individuals, on the other hand, were found only in the surface layer in this locality during the corresponding period (cf. Fig. 24). Fig. 25 shows the vertical distribution of some common Camisiid species.

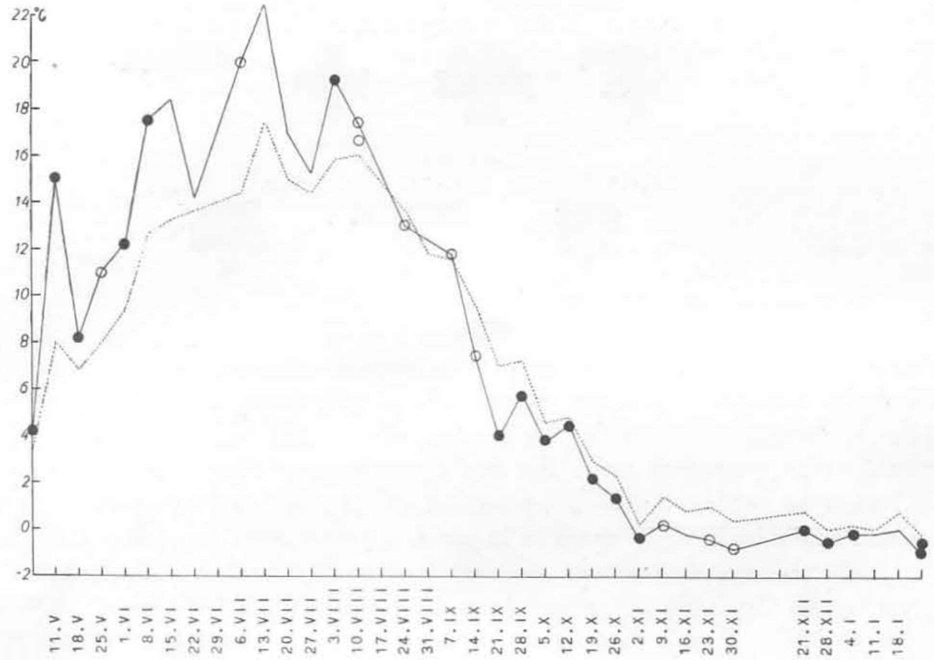


Fig. 26. Effect of temperature upon the abundance of *Platynothrus peltifer* on an alluvial marsh at Iitti (EH), on 4. V. 1952 — 25. I. 1953. ○ = 1 — 2, ● = 3 or more individuals per sample. ——— = 0 — 1 cm, ········ = 3 — 5 cm depth.

High temperature may have a disastrous effect upon the species occurring in the surface layer in quite a few cases. Thus, for instance, *Platynothrus peltifer* seems to be reduced to a small fraction of its numbers by the midsummer heat. Fig. 26 shows the changes in the number of individuals of *Platynothrus peltifer* in relation to the temperature of the alluvial marsh and the season. There can hardly be any other reason for the small number of individuals during the period 8. VI — 14. IX than the desiccation of the surface layer due to the high midsummer temperature, to which this species is not sufficiently resistant. Since the species occurs almost exclusively in the surface layer, the natural consequence of drought is a reduction of the population to a very small fraction, evident in the diagram as the occurrence of only a few dispersed finds in summertime. In the spring the species occurred in greater abundance, and again in the autumn, when the temperature was abating and the moisture was simultaneously increasing, but not before the end of September had the species been able to reproduce to such an extent that it could be considered abundant. After 2. XI the abundanc of this species decreased again. Probably the reason this time was that about 5 cm of snow fell on 2. XI, the temperature was below 0° C. for the first time that year and the surface soil froze, whereupon the development from egg to adult was interrupted by

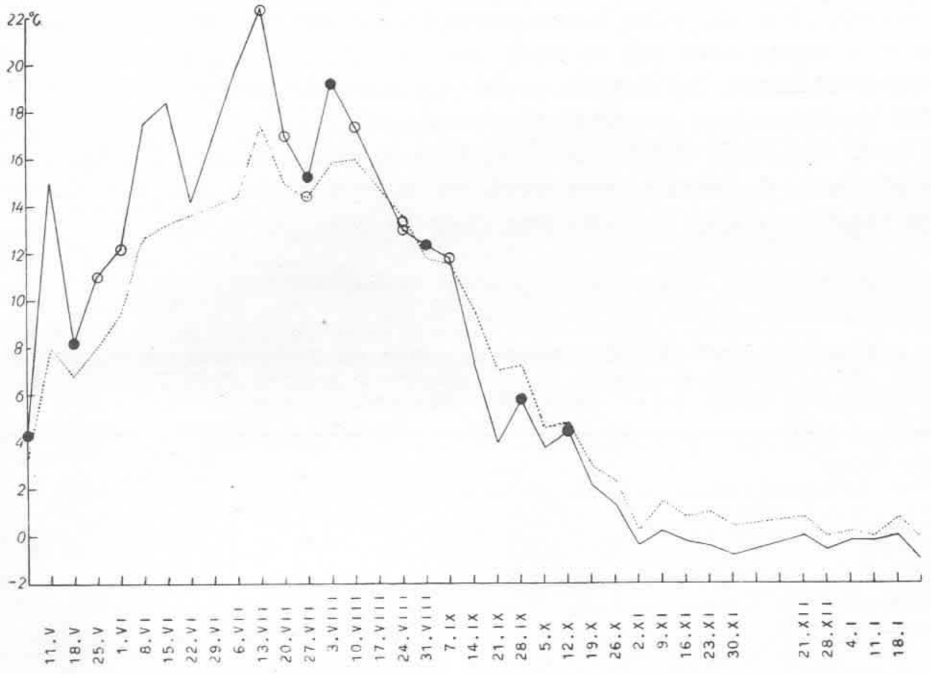


Fig. 27. Effect of temperature upon the abundance of *Nothrus pratensis* on an alluvial marsh at Iitti (EH), on 4. V. 1952 — 25. I. 1953. ○ = 1, ● = 2 or more individuals pel sample. ——— = 0 — 1 cm, ········ = 3 — 5 cm depth.

the unfavourable conditions. On 30. XI the thickness of the snow cover was already as much as 45 cm. Thereafter the species began to occur in greater abundance again.

In the same way Fig. 27 shows the occurrence of *Nothrus pratensis* in the same locality. In this case it is particularly striking that the species was completely absent after 12. X. In some other types of localities this species occurs even in the winter. In the *LkN*, for instance, it moves out of the surface layer, even though it otherwise thrives best in this type at a depth of 0 — 1 cm (Table 11 and Fig. 28). In the alluvial marsh the species thrives in the surface layer, but it does not move downwards with the decrease of temperature, and the consequence is a considerable reduction of the population. Naturally this reduction cannot be observed except with regard to the larvae, nymphs and adults. Probably the egg stage of the mites has a considerably higher

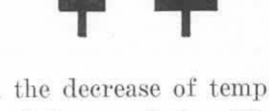


Fig. 28. Seasonal changes in the vertical distribution of *Nothrus pratensis* on LkN at Pasila.

resistance than the other instars; thus in the case of those species where no development from egg to adult can take place during the unfavourable winter conditions, the increase of the population starts again in the spring, after conditions have become more advantageous, mainly from hibernated eggs. It seems very likely that the Camisiids have no regular periods of reproduction coupled with the seasons, from which the changes in abundance would result. The same observation has also been made by STRENZKE (1952).

Table 8. Vertical distribution of *Platynothrus peltifer* and *Nothrus pratensis* on an alluvial marsh (*TN*) and *Nothrus palustris* and *N. silvestris* in a forest of *OMT* at Iitti (EH), 4. V. 1952 — 25. I. 1953.

	T N					*O M T*			
	Platynothrus peltifer		*Nothrus pratensis*			*Nothrus palustris*	*Nothrus silvestris*		
Date	0 — 1 cm	1 — 3 cm	0 — 1 cm	1 — 3 cm	3 — 5 cm	0 — 1 cm	0 — 1 cm	1 — 3 cm	3 — 5 cm
4. V	8	—	2	—	—	—	—	—	—
11. V	3	—	—	—	—	—	1	1	—
18. V	3	—	2	—	—	—	2	—	—
25. V	2	—	1	—	—	1	1	—	—
1. VI	7	—	1	—	—	—	—	—	—
8. VI	5	—	—	—	—	—	—	1	—
15. VI	—	—	—	—	—	1	—	—	1
22. VI	—	—	—	—	—	—	—	—	—
6. VII	2	—	—	—	—	1	—	—	—
13. VII	—	—	1	—	—	—	—	—	—
20. VII	—	—	1	—	—	3	—	—	—
27. VII	—	—	2	—	1	—	1	—	—
3. VIII	4	—	3	—	—	—	—	—	—
10. VIII	1	1	1	—	—	1	—	—	—
24. VIII	2	—	1	1	—	2	—	—	—
31. VIII	—	—	3	—	—	2	—	—	—
7. IX	2	—	1	—	—	2	—	—	—
14. IX	1	—	—	—	—	2	—	—	—
21. IX	6	—	—	—	—	—	—	—	—
28. IX	3	—	11	—	—	1	4	—	—
5. X	8	—	—	—	—	2	—	—	—
12. X	6	—	2	—	—	1	—	—	—
19. X	4	—	—	—	—	1	2	—	—
26. X	4	—	—	—	—	—	—	1	—
2. XI	4	—	—	—	—	—	—	—	—
9. XI	2	—	—	—	—	—	—	—	—
16. XI	—	—	—	—	—	—	—	1	—
23. XI	2	—	—	—	—	—	—	—	—
30. XI	1	—	—	—	—	—	—	2	—
7. XII	—	—	—	—	—	1	—	—	—
14. XII	—	—	—	—	—	1	—	1	—
21. XII	3	—	—	—	—	—	—	—	1
28. XII	3	—	—	—	—	—	—	—	—
4. I	3	—	—	—	—	—	—	1	1
11. I	—	—	—	—	—	—	—	—	—
18. I	—	—	—	—	—	—	1	—	—
25. I	6	12	—	—	—	—	—	—	—
Total	95	13	32	1	1	22	12	8	3

Table 9. Vertical distribution of *Nothrus silvestris* and *Camisia lapponica* on a drained peatland (*VTk*). Pasila, near Helsinki city, 29. X. — 3. XII. 1950.

	Nothrus silvestris							*Camisia lapponica*						
Depth, cm	Date 29. X	6. XI	26. XI	26. XI	3. XII	3. XII	Total	29. X	6. XI	26. XI	26. XI	3. XII	3. XII	Total
0 — 1	4	2	—	1	—	—	7	1	2	—	—	1	1	5
1 — 3	1	1	1	1	3	4	11	—	—	—	—	—	—	—
3 — 5	—	4	—	2	2	7	15	—	—	—	—	—	—	—
Total	5	7	1	4	5	11	33	1	2	—	—	1	1	5

Table 10. Vertical distribution of *Nothrus silvestris* and *Heminothrus paolianus* in a Myrtillus type forest. Pasila, near Helsinki city, 7. V. — 3. XII. 1950.

	Nothrus silvestris															
Depth, cm	Date 7. V	21. V	4. VI	18. VI	2. VII	16. VII	30. VII	13. VIII	27. VIII	10. IX	24. IX	8. X	26. XI	3. XII	3. XII	Total
0 — 1	8	3	1	5	—	9	4	—	—	6	3	4	—	—	—	43
1 — 3	3	2	1	1	1	5	4	6	4	2	2	1	3	—	—	35
3 — 5	1	—	1	—	1	—	1	3	2	—	—	—	—	3	—	12
Total	12	5	3	6	2	14	9	9	6	8	5	5	3	3	—	90

	Heminothrus paolianus															
Depth, cm	Date 7. V	21. V	4. VI	18. VI	2. VII	16. VII	30. VII	13. VIII	27. VIII	10. IX	24. IX	8. X	26. XI	3. XII	3. XII	Total
0 — 1	4	6	—	3	—	1	1	1	—	4	2	—	—	—	—	22
1 — 3	—	—	1	—	—	—	—	3	2	—	—	—	—	—	—	6
Total	4	6	1	3	—	1	1	4	2	4	2	—	—	—	—	28

Table 11. Vertical distribution of *Nothrus pratensis* in a peatland of the *LkN* type. Pasila, near Helsinki city, 7. V. — 3. XII. 1950.

Depth, cm	Date 7. V	21. V	4. VI	18. VI	2. VII	16. VII	30. VII	13. VIII	27. VIII	10. IX	24. IX	8. X	26. XI	3. XII	3. XII	Total
0 — 1	—	1	3	2	—	2	2	5	5	2	6	1	—	3	3	35
1 — 3	1	1	5	4	2	1	—	—	3	—	1	7	7	8	2	42
3 — 5	—	—	—	—	—	—	—	—	1	—	2	2	—	1	—	6
Total	1	2	8	6	2	3	2	5	9	2	9	10	7	12	5	83

D. THE ECOLOGICAL VALENCE OF THE SPECIES INVESTIGATED

The ecological valence of a species is a characteristic which reflects the amount by which conditions may vary in the habitats where the species is able to exist. When investigating the ecological valence a number of localities as widely different as possible should be studied. The preliminary conditions for such an investigation are by no means the same everywhere. In Finland, for instance, the variations in pH are rather small as compared, for instance, with the Central European countries, where the bedrock is of quite a different character. Even approximately neutral soils are scarce in this country, not to mention basic soils.

With regard to organic matter and moisture I have employed a classification similar to that employed by STRENZKE (1952). With regard to moisture, samples which when held do not wet the hand are classified as dry, those which wet the hand but where the water does not drip off are classed as intermediate, and those from which water drips when the sample is held in the hand as moist. The classification with regard to organic matter is as follows: Mineral soils: substratum pure mineral, or only very insignificant organic component; intermediate soils: both mineral and organic substances in about equal amount in the substratum; humus soils: purely organic substratum, or very insignificant amount of mineral matter.

When attempts are made to investigate the influence upon the fauna of certain factors, it is, properly speaking, incorrect to treat the pH value as such a factor, since actually the pH is the result of the simultaneous action of a great number of different factors. Even in this sense, however, as the indication of the combined effect of a number of factors, which are often difficult to investigate separately, the pH figures have a remarkable significance.

STRENZKE (1952) has classified the samples from Northern Germany in accordance with their pH in three groups as follows:

Oligotype: $pH < 6.5$
Mesotype: $pH = 6.5 - 7.5$
Polytype: $pH > 7.5$

Since, according to STRENZKE's classification, nearly all the forest and peatland types of Finland and actually all the types investigated in this work belong to the "oligotype", a different system of division was adopted better fitted to the conditions existing in this country. It is my opinion that there cannot be any universally valid system of classification in this respect; on the contrary, the classification has to be planned in accordance with the conditions existing in the region under investigation. In consideration of the particular conditions in Finland I have classified the samples in accordance with their pH into three groups as follows:

Group A $\mathrm{pH} < 4$
„ B $\mathrm{pH} = 4 — 5$
„ C $\mathrm{pH} > 5$

It is evident that the results are not directly comparable with those obtained in Northern Germany. The results of the pH measurements carried out on the different forest and peatland types can be seen in Table 12.

Table 12. The results of the pH determinations on the different forest and peatland types.

Locality	pH range	Locality	pH range
ClT	3.5 — 3.7	*Corylus* thicket	4.4 — 5.4
CT	4.1 — 4.2	*VK*	4.1 — 5.0
EMT	3.3 — 3.6	*IR*	3.4 — 3.6
VT	3.9 — 4.3	*TR*	3.6 — 3.9
HMT spruce stand	3.8 — 4.0	*VeN* (Helsinki)	5.9 — 6.2
HMT birch stand	3.8 — 4.5	*VeN* (Tvärminne)	5.9 — 6.2
MT	4.3 — 5.6	*TN*	4.6 — 5.2
OMT	4.8 — 5.6	*LkN*	3.5 — 3.7
OMaT	4.2 — 4.9	*VTk*	3.4 — 3.7

The distribution of the samples in terms of the strength of the said 3 environmental factors is seen from Table 13.

Table 13. Distribution of the samples in accordance with the strength of the three environmental factors.

	Dry $\mathrm{pH} < 4$ Mineral soil	Intermediate pH 4 — 5 Intermediate	Moist $\mathrm{pH} > 5$ Humus soil	Total number
Water content	50	40	50	140
Acidity	50	70	20	140
Humus	20	50	70	140

The method of calculation is the same as was used by STRENZKE (1952, p. 3). The graphical representation of this relationship gives a clear picture of the ecological valence of the different species (Fig. 29). Thus, *Heminothrus thori* has the lowest valence and *Nothrus silvestris* the highest. The latter may thus occur on widely different types, the former only on a few types, where the factors are not materially different. *Camisia lapponica* otherwise occurs on rather variable types, but higher pH's may act as an inhibiting factor. In this way it is easy to see from the figure which factors are prohibitive with regard to the occurrence of each species. *Platynothrus peltifer* is thus a species preferring high moisture. Since the *HMT* spruce stand (cf. p. 38) has a higher moisture content than the *HMT* birch stand, the former is more favourable for this species. Similarly *Nothrus pratensis,* also a species requiring high moisture, may still occasionally occur in a spruce stand, but not at all in the drier birch stand. The pH "optimum" for *Nothrus pratensis* lies in the more acidic part of the pH scale; this partly accounts for the fact that this species is encountered only in the *HMT* spruce stand. It must be admitted that there

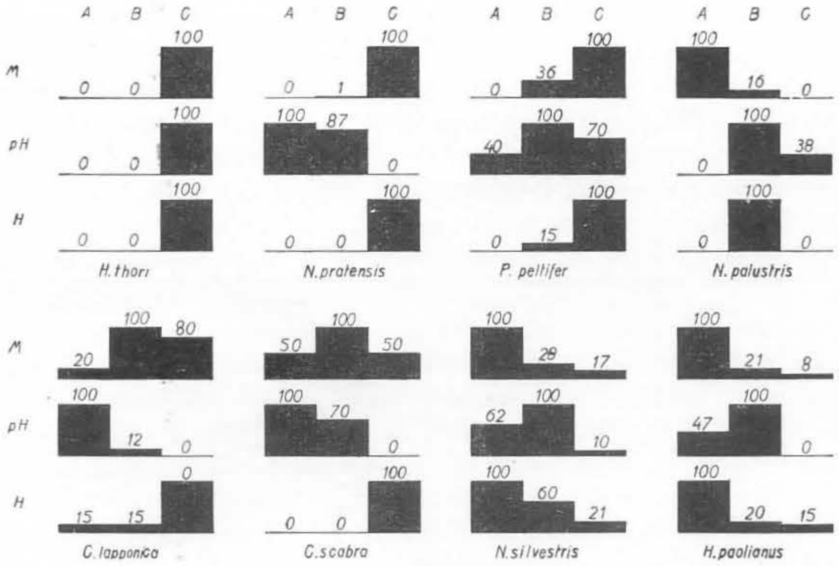


Fig. 28. The ecological valence of some of the commonest Camisiid species of Finland, as indicated by their relations to soil moisture, the pH and the humus content of the soil. In each column, A indicates dry soil, pH <4, and mineral soil, B intermediate moisture, pH 4—5 and intermediate soil, C high moisture, pH >5 and humus soil.

is only an insignificant difference in pH between the *HMT* spruce and birch stand, but according to SIRÉN (1952) the pH falls with increasing age of the *HMT*, and even this difference, which may possibly be only apparent in this case, may contribute to the significant faunistic differences between the types.

E. ABUNDANCE OF THE CAMISIID SPECIES

Since in the series of 100 samples taken from different forest and peatland types the samples were of the same size as the actual quantitative samples, it was also possible to calculate from these samples the abundances of the various species. It is then also possible to ascertain the total number of individuals per unit volume of the Camisiid fauna in the different types (Table 14). There seems no point in calculating the dominance values, as only part of one group of animals is dealt with (cf. TUOMIKOSKI 1949). In my opinion it is safest in describing the incidence of the species, to employ either the constancy or the abundance, which then gives the number of individuals per 50 cc. In all the tables presented in the foregoing the abundances have been stated in this form. In Table 14 the abundance has been computed per 1000 cc.

Table 14. Mean abundance (individuals per 1000 cc.) of the various Camisiid species and total numbers of Camisiids on some forest and peatland types, calculated on the basis of the samples investigated.

	Nothrus silvestris	*N. palustris*	*N. pratensis*	*N. borussicus*	*N. biciliatus*	*Camisia scabra*	*C. lapponica*	*C. spinifer*	*C. segnis*	*Heminothrus paolianus*	*H. targionii*	*H. thori*	*Platynothrus peltifer*	*Neonothrus humicola*	Total number
ClT	41						×			2	×				47
CT	6					×	×		×	40	×				46
VT	16					×	×			6					22
HMT, birch stand							1			×			1	16	18
HMT, spruce stand			×							6			25	3	34
MT	49						2			3	×				54
OMT	4	4													8
OMaT	4	×													4
Corylus thicket	24	9			×								13		46
VK	26		27							2			5		60
VeN (Tvärminne)	×											71	88		159
VeN (Helsinki)			×									71	25		96
LkN			36				×								36
TN			16				×						20		36
VTk	36			×		2	8	4		2					52

6. SUMMARY

The main part of the Camisiid material for the present study, the first part of an investigation of the Oribatid mites of Finland, was collected in connection with the transect survey of the Finnish forests. The transect survey material consists of 1595 soil samples from localities distributed fairly uniformly all over the country. From NW. Finnish Lapland (province *EnL*) there is, however, a single sample only. The localities for the transect survey sampling were selected in order to get an idea of the Oribatids of the commonest forest and bog types of Finland, i.e., the Vaccinium type forests, and the pine bogs. Since *VT* forests do not occur in N. Finland, the samples from this region were collected from Empetrum-Myrtillus type forests which resemble the *VT* of Southern and Central Finland. With additional material collected by the author, there are altogether samples from 21 different localities, mostly 100 samples from each. The total number of samples employed in estimating the ecological range of the different species, their constancy and abundance is 2 695. Additional samples were collected from a few selected localities in order to study the effect upon the Camisiids of certain environmental factors. The effect of the ground vegetation upon the minor features of distribution of the Camisiids was studied on the basis of 108 and 324 samples from a pine peat-bog collected in 1950 and 1951, respectively. The effect of changes of temperature and moisture was studied on the basis of similar sample series from *OMT* (111 samples), *MT* (45), *VTk* (18), *TN* (111) and *LkN* (45), all collected in 1950 — 52, i.e. 762 samples. The number of Camisiid samples collected for the present study is thus altogether 3 457.

In the handling of the soil samples I have used a certain modification of BERLESE's device.

A study of the distribution in Finland of the different Camisiid species reveals that some of them (*Nothrus pratensis, Heminothrus paolianus, Camisia lapponica,* e.g.) occur all over the country; the first-mentioned is commonest in those parts of the country where bogs are most frequent, whilst the third is the most abundant in N. Finland. Other species seem to be confined to more or less restricted areas of the country, as for example, *Nothrus silvestris,* the commonest Camisiid species of the forests of Southern and Central Finland, with northern limit roughly at lat. 65°30′ N. *Neonothrus humicola* is a boreal species so far known from N. Sweden only; it is established in the northern, central and southwestern parts of Finland, but has not been found in Southern and Southeastern Finland. Owing to the small number of localities known so far, the area of distribution within Finland of several Camisiid species with specialized ecological requirements still remains insufficiently known. Among such species *Heminothrus thori* may be instanced. So far it has been found in a few localities on the south coast of Finland only, but future studies of its typical habitats (water swamps) will probably show that its range is considerably wider than known to date.

A study of the number of Camisiid species of the different biological provinces of Finland reveals that the greatest number of species (11 out of 17 spp.) is now known from the province of Uusimaa (U), S. Finland. Next come the provinces Satakunta (St) and Etelä-Häme (EH) with 10 spp. each. As the numbers of samples collected from the different provinces are not equal, the figures for the different provinces may change to a certain degree. Two species (*Heminothrus paolianus* and *Nothrus pratensis*) are known from 18 provinces out of 19.

According to the classification by BROCKMANN-JEROSCH, *Nothrus silvestris, Heminothrus paolianus* and *Camisia lapponica* belong to the so-called constant species of the forests of Finland. The constant species of the bogs are: *Nothrus pratensis, Heminothrus paolianus, Camisia lapponica* and *Nothrus silvestris.* These lists of the most common and significant species of the forests and bogs thus show a striking similarity. On the other hand, the accessory and accidental species are markedly different in these two formations.

A study of several areas of one and the same pine bog with very different vegetation revealed that both the specific composition and the abundance re-

vegetation revealed that both the specific composition and the abundance

relations varied according to the vegetation. In the sample plots studied, the number of Camisiids was distinctly lowest in the *Polytrichum* carpets (less than 1 % of the total number of Camisiids), whilst the highest abundance of the Camisiid populations was observed in the *Cladina* and *Sphagnum* habitats (32 and 25 %, respectively). Consequently the raw humus formed from *Polytrichum* is most probably poor in food material suitable for the mites, i.e., it probably contains very little fungal mycelium, which is their most important food.

A similar influence of the vegetation was also observed in an *HMT* forest of N. Finland. The faunas of an *HMT* birch stand and a spruce stand were very different, probably owing to differences in the raw humus caused by different ground vegetation (in this case also the tree stratum).

In view of these results, for any investigation of the qualitative and quantitative distribution of soil mites the samples should be taken from particular spots where the ground vegetation is typical of the locality in question. The most correct idea of the mites of a certain locality will, however, be obtained by collecting samples from each different plant association present. The samples obtained in this way will, as an aggregate, be representative of the entire locality in question.

Persistent and prolonged changes of temperature and moisture cause a vertical displacement of the Camisiid fauna. Among others the populations of *Nothrus silvestris* and *Heminothrus paolianus* living in the *MT* forests migrate into deeper layers during spells of fine weather that cause desiccation of the surface layer. At the time of the freezing of the soil and the thawing of the ground frost vertical movements take place to a remarkable degree; in the species concerned, this movement is either towards the deeper layers or in the opposite direction. In the spring, when the temperature of the surface overtakes that of the deeper layers, most species migrate towards the surface, but *Camisia lapponica* moves towards the colder, deeper layers. In the autumn, when the reverse change in the temperature takes place, the Camisiids move towards the surface. However, there are species which move vertically in accordance with the seasons in some localities, whereas no such displacement can be observed in other habitats. An example of this behaviour is *Nothrus silvestris,* which moves downwards under the influence of drought, as was mentioned above. In the same locality from which these observations have been recorded, the species does not move into deeper layers at the onset of winter, whereas such a displacement is distinctly observable in the *OMT* and in the *VTk* type.

In those species which do not move into more favourable conditions for the winter, a considerable decrease of the population density occurs during this time, since probably no development from egg to adult takes place under such circumstances. When better conditions return, development starts again, and adults which are practically absent during the winter begin to appear once more. It is likely that the normal development which continues uniformly throughout the year under suitable conditions, is also interrupted, at least in the case of certain species, by the influence of the high midsummer temperature and the attendant drought. *Platynothrus peltifer* is a species of this type; adults of the species occur very sparsely in the summer, whereas they are clearly more abundant in the spring and autumn even in the winter.

When studying the ecological valence of the various species, a rough classification of the localities according to their moisture, pH and humus content of the soil was employed. The results presented in Fig. 29 give an idea of which of the three factors investigated appears to have greatest influence on the occurrence of each species. Of the Finnish Camisiids *Nothrus silvestris* has the highest and *Heminothrus thori* the lowest ecological valence.

A study of the abundance of the Camisiid species in the different types of forests and peatlands reveals that all the species investigated occur in comparatively small numbers. In a few samples only a certain species was found in very high abundance (e.g. more than 400 ind./1000 cc. for *Heminothrus thori*), but on ocenut of the non-uniform occurrence the average abundance computed from 100 samples (Table 14, p. 73) remains rather low. In localities where the conditions are distinctly exceptional in some respect, certain Camisiid species may occur in unexpectedly high abundance. In the *VeN* type, for instance, which is distinctly different from the other bogs at least in regard to the pH and the salt content (the latter not investigated), the abundance values of the species are conspicuously high and the total number of Camisiids is also distinctly higher than in any other localities.

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SELOSTUS

SUOMEN CAMISIIDAE-PUNKKEJA KOSKEVIA EKOLOGISIA JA LINJA-ARVIOINTITUTKIMUKSIA

Suomen Camisiidae-punkkeja koskevia tutkimuksia varten tallennettiin metsiemme kolmannen linja-arvioinnin yhteydessä 1 595 näytettä, jotka saatiin verrattain tasaisesti koko maastamme, lukuunottamatta Enontekiön Lappia. Näytteet otettiin siten, että niiden perusteella saadaan käsitys puolukkatyypin metsän, Suomen yleisimmän metsätyypin, sekä rämeen, Suomen yleisimmän suotyypin faunasta. Koska puolukkatyypin metsiä ei esiinny Pohjois-Suomessa, otettiin sieltä vastaavat näytteet variksenmarja-mustikkatyypin metsistä, jotka lähinnä vastaavat Etelä- ja Keski-Suomen puolukkatyyppiä. Jotta eri olinpaikkojen Camisiidipunkkilajiston selvittäminen ei olisi jäänyt vain näiden kolmen tyypin varaan, otettiin lisäksi 100 näytteen sarjoja mahdollisimman monelta erilaiselta olinpaikalta niiden lajikoostumuksen sekä eri lajien konstanssin ja abundanssin toteamiseksi. Tulokset perustuvat siten yhteensä

2 695 näytteeseen. Eräiden ympäristötekijäin vaikutuksen tutkimiseksi otettiin säännöllisin väliajoin lisäksi 762 näytettä. Näytteiden kokonaismäärä on täten 3 457.

Eräät Camisiidipunkit (esim. *Nothrus pratensis, Heminothrus paolianus* ja *Camisia lapponica*) esiintyvät koko Suomessa, ensinmainittu kuitenkin yleisimpänä sillä alueella, missä soita on runsaimmin, viimemainittu taas Pohjois-Suomessa. *Nothrus silvestris* on yleisin Etelä- ja Keski-Suomen metsissä esiintyvistä Camisiidipunkeista; sen alue näyttää käsittävän vain 66 leveysasteen eteläpuolisen osan maastamme. Levinneisyydeltään pohjoinen laji on *Neonothrus humicola,* joka on toistaiseksi löydetty vain Pohjois-, Keski- ja Lounais-Suomesta. Tämä laji tunnettiin ennestään vain Pohjois-Ruotsista.

Useiden Camisiidipunkkien levinneisyydestä ei toistaiseksi voida saada selvää käsitystä. Esim. *Heminothrus thori* on löytynyt vain etelärannikoltamme, mutta saattaa esiintyä muuallakin merenrantojen vesinevoilla, jotka ovat sen luonteenomaisia olinpaikkoja. *Platynothrus punctatuksen* löytö Inarista liittyy luontevasti sen aikaisemmin tunnettuun levinneisyysalueeseen, kun taas *P. capillatus* var. *septentrionaliksen* löytyminen Ahvenanmaalta on yllättävää, koska tämä laji aikaisemmin tunnettiin vain Grönlannin länsirannikolta.

Maamme 17 Camisiidilajista tunnetaan 11 Uudeltamaalta, 10 Satakunnasta ja Etelä-Hämeestä; muista maakunnistamme tunnettujen lajien määrä on toistaiseksi vähäisempi. Tuloksiin vaikuttaa tietenkin se, että eri maakunnista saatujen näytteiden määrä on varsin erilainen. Tasaisimmin kautta koko maan esiintyviä lajeja näyttävät olevan *Heminothrus paolianus* ja *Nothrus pratensis,* jotka tunnetaan 18 maakunnasta.

Kaikkien erityyppisten metsiemme vakiolajeja ovat *Nothrus silvestris, Heminothrus paolianus* ja *Camisia lapponica,* soittemme vakiolajeja samaten nämä kolme lajia sekä lisäksi *Nothrus silvestris.* Metsiemme ja soittemme vakiolajit ovat siis *Nothrus silvestristä* lukuunottamatta samat. Harvinaisempina esiintyvien lajien kohdalla metsä- ja suoformaatiot poikkeavat sensijaan varsin selvästi toisistaan.

Erään rämeen eri kasvillisuuslaikuilta otettujen näytteiden Camisiidilajisto ja eri lajien runsaussuhteet olivat sangen erilaiset. Punkit näyttivät erityisesti karttavan karhunsammallaikkuja; karhunsammalesta muodostuvassa raakahumuksessa lienee niukalti sienirihmastoa, punkkien tärkeintä ravintoa. Suurimmat yksilömäärät saatiin poronjäkälä- ja rahkasammallaikuilta. Aluskasvillisuuden olennainen vaikutus punkkilajistoon voitiin havaita myös tutkittaessa Pelkosenniemen Siulionpalosta tallennettua paksusammaltyypin metsän koivikon ja kuusikon faunaa. Havaitut erot johtunevat tässäkin tapauksessa erilaisen aluskasvillisuuden aiheuttamasta raakahumuksen erilaisuudesta.

Eri metsä- ja suotyyppien punkkifaunaa tutkittaessa olisi siis näytteet otettava ensi sijassa sellaisilta kasvillisuuslaikuilta, jotka ovat tutkittavalle olinpaikalle luonteenomaisia, mieluimmin kuitenkin siten, että näytealat antavat edustavan käsityksen asianomaisen suo- tai metsätyypin erilaisten aluskasvillisuuslaikkujen faunasta.

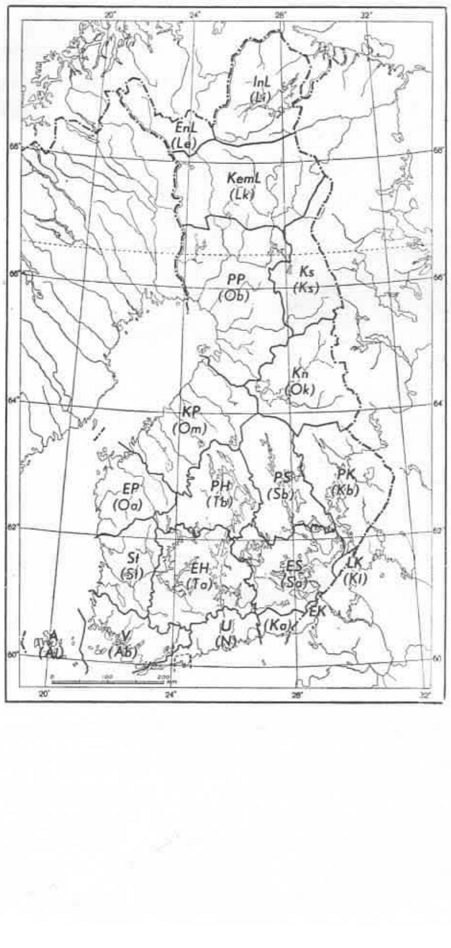
Lämpötilan ja kosteuden pysyvät, pitkäaikaiset muutokset saavat aikaan punkkien vertikaalisia siirtymisiä. Maaperän kuivuessa pitkähkön poutakauden aikana mm. *Nothrus silvestris* ja *Heminothrus paolianus* siirtyvät mustikkatyypin metsissä pintakerroksesta syvemmälle Erityisen runsaasti tapahtuu vertikaalisia siirtymisiä maan routaantumisen ja roudan sulamisen aikoina. Kun maan pintakerroksen lämpötila kohoaa syvempänä olevien kerrosten lämpötilaa korkeammaksi, useimmat lajit siirtyvät pintaa kohden. *Camisia lapponica* on kuitenkin poikkeus; se siirtyy näissä olosuhteissa syvempiin kerroksiin. Kun taas syksyllä pintakerroksen lämpötila muuttuu syvempien kerrosten lämpötilaa alemmaksi, tapahtuu päinvastaisia siirtymisiä. Näyttää kuitenkin siltä, että tietyt lajit käyttäytyvät eri tavoin eri olinpaikoilla; niinpä *Nothrus silvestriksen* käenkaali-mustikkatyypin metsissä sekä puolukkaturvekankaalla elävät populaatiot siirtyvät syksyllä syvemmälle, kun taas mustikkatyypin metsissä elävien populaatioiden ei voitu havaita suorittavan tätä siirtymistä.

Jos laji ei siirry talvehtimaan edullisempiin olosuhteisiin, sen populaatiot pienenevät talven aikana huomattavasti, sillä vanhat aikuiset kuolevat, eikä nuorten yksilöiden kasvua voine ainakaan mainittavassa määrin tapahtua. Alkukevään jälkeen näytteisiin alkaa jälleen ilmaantua aikuisia, jotka talven aikana ovat olleet miltei tyystin kateissa. Eräiden lajien kehitys näyttää keskeytyvän myös keskikesän korkeiden lämpötilojen vaikutuksesta; niinpä *Platynothrus peltifer*in aikuisia löytyy keskikesän näytteistä sangen vähän, mutta syksyn ja talven näytteistä varsin runsaasti.

Monilta eri olinpaikoilta otettujen näytteiden perusteella voidaan saada suhteellisen selvä käsitys eri lajien suhtautumisesta maaperän kosteuteen, happamuuteen ja humuspitoisuuteen. Suomen *Camisiidae*-punkeista *Nothrus silvestris* on kaikkein vaatimattomin, *Heminothrus thori* taas vaateliain.

Camisiidae-heimon punkit esiintyvät Suomessa yleensä suhteellisen harvalukuisina. Muutamia lajeja saattaa toisinaan olla runsaastikin (esim. lajia *Heminothrus thori* oli eräissä näytteissä jopa yli 400 yksilöä / 1 000 sm^3), mutta erilaisten olinpaikkojen punkkipopulaatioiden yksilörunsaudessa havaittiin hyvin suuria vaihteluita.

Tutkimukseen liittyvät levinneisyyskartat kaikista Suomessa tavatuista *Camisiidae*-heimon lajeista.



The biogeographical provinces of Finland. The provinces which are partly in the area of the Soviet Union are printed in italics. The old Latin nomenclature is given in brackets.

A (Al) = Ahvenanmaa (Alandia)
EH (Ta) = Etelä-Häme (Tavastia australis)
EK (Ka) = Etelä-Karjala (Karelia australis)
EnL (Le) = Enontekiön Lappi (Lapponia enontekiensis)
EP (Oa) = Etelä-Pohjanmaa (Ostrobottnia australis)
ES (Sa) = Etelä-Savo (Savonia australis)
InL (Li) = Inarin Lappi (Lapponia inarensis)
KemL (Lk) = Kemin Lappi (Lapponia kemensis)
Kn (Ok) = Kainuu (Ostrobottnia kajanensis)
KP (Om) = Keski-Pohjanmaa (Ostrobottnia media)
Ks (Ks) = Kuusamo
LK (Kl) = Laatokan Karjala (Karelia ladogensis)
PH (Tb) = Pohjois-Häme (Tavastia borealis)
PK (Kb) = Pohjois-Karjala (Karelia borealis)
PP (Ob) = Pohjois-Pohjanmaa (Ostrobottnia borealis)
PS (Sb) = Pohjois-Savo (Savonia borealis)
St (St) = Satakunta
U (N) = Uusimaa (Nylandia)
V (Ab) = Varsinais-Suomi (Regio aboënsis)